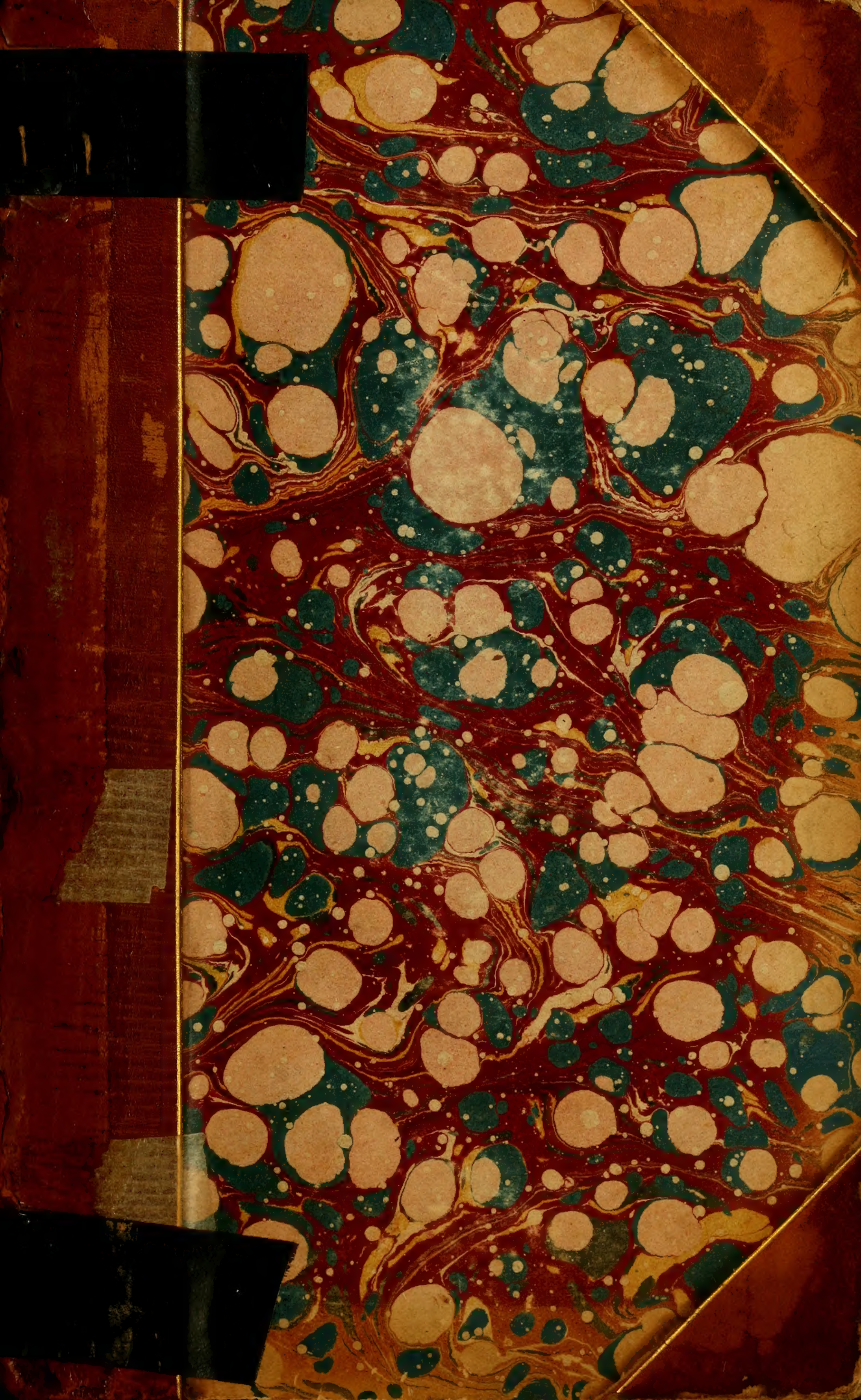

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PROCEEDINGS

OF THE

BOSTON SOCIETY OF NATURAL HISTORY.

TAKEN FROM THE SOCIETY'S RECORDS.

May 16, 1866.

The President in the chair. Twenty-five members present.

Dr. B. Joy Jeffries made a communication on the Anatomy and Physiology of the Ciliary Muscle in Man.

At a meeting of the Society in January, 1865, I made some remarks on the anatomy and physiology of the ciliary muscle in man, and as recent investigations have seemed to confirm them, I shall take the liberty of presenting these in support of my views. I said that I followed others in considering that the ciliary muscle in man, by contracting upon its origin slackened up the suspensory ligament, and thus allowed the lens to become more convex, thereby accommodating the refractive media of the eye to the divergent rays of light from near objects and focussing them on the retina. In placing together the anatomical accounts of this muscle, I could not make out that the muscular fibres known as Müller's circular fibres, are a distinct mass enabled to act together as a separate part of the whole muscle. In this I am now further confirmed by the investigation of Meyer, from whom I have roughly copied these drawings. From this I think it will be seen that these circular fibres can in contracting but assist the action of the meridional ones.

From George Meyer's (Med. Student in Bremen) Essay on the Comparative structure of the Annulus ciliaris in Man and Mammals, to which a prize was awarded by the Faculty of Heidelberg. R. Virchow's Archiv, November, 1865.

The *Annulus ciliaris* in *man* is attached by a very thick fibrous net to the posterior and inner wall of Schlemm's canal, and over a short space of the adjacent sclerotic. The fibre bundles run in various directions from Schlemm's canal, some as a meridional layer directly backwards, lying close against each other to their insertion in the choroid, and others in a curve from outwards inwards (concavity towards centre of eye). These last bundles form numerous intercommunications, and divide up into several smaller ones to again unite further on. There are thus formed numerous open spaces which are mostly filled with Müller's circular fibres. These open spaces are more frequent over the ciliary processes, and therefore most circular fibres are here found. These circular fibres also frequently interlace; often some of the muscular bundles pass from their meridional direction into a circular one.

Prof. J. Henle's description and drawings of the ciliary muscle, lately published, agree with Meyer's. In his physiological remarks he considers "that the action of the circular and meridional fibres mutually assist each other in increasing the thickness of the muscle." He says that accommodation takes place as I have held, "produced as far as we can now see by the ciliary muscle, but in what manner the latter acts is still *unproved.*"

I also stated that the annulus ciliaris or ciliary muscle differed so much in animals from man that it was useless to attempt to adduce from them the mechanism of accommodation in man, and had on this account desisted myself. Meyer's investigations seem to bear me out in this also, as will be seen from these two rough drawings of the ciliary muscle of a wild cat, and the annulus ciliaris of an antelope. Meyer examined a number of different animals, still hardly enough to draw a complete conclusion. His results are as follows:

The *Annulus ciliaris* of the *apes* consists of very long contractile fibre cells. Its topographical relations greatly resemble the human as regards origin, insertion and form. Open spaces are rarely present in the tissue, and Müller's fibres are entirely wanting.

The *Annulus ciliaris* of the *carnivorous animals* is muscular in character, its fibres run from before directly backward, and leave no interspaces. The circular muscular bundles, and the so-called intercommunicating fibres, are entirely wanting.

The *Annulus ciliaris* of the *rodents* is formed either of sub-scleral tissue or true connective tissue; it is at any rate very insignificant, and in some hardly perceptible.

The *Annulus ciliaris* of the *pachydermata* consists of connective tissue, the separate bundles of which lie without interspaces so close together as to render them readily mistaken for muscular fibres. The ciliary band is in them thin, but extends far backwards.

The *Annulus ciliaris* of the *solipeds*, as in the horse, consists of a fine net of connective tissue stretched transversely from sclerotic to choroid. The whole tissue is thin and insignificant; nothing is seen of a compact mass.

The *Annulus ciliaris* of the *ruminants* appears as a firm mass of grayish white color consisting of connective tissue. It is wedge shaped, placed between the sclerotic and choroid, and varies considerably in its dimensions. The individual bundles lie here also close together so as to leave no interspaces.

In Vol. XI, Part third, of the "Archiv für Ophthalmologie," Dr. Heiberg of Christiania has published an article on the anatomy and physiology of the Zonula Zinnii, in which he concludes from microscopical examination that there are in it true muscular fibres, which he thinks by pulling on the capsule of the lens, flatten it, and thereby adapt it for rays from distant objects, producing what has been called negative accommodation. He gives microscopic drawings of these fibres from the zonula of the horse, and also from man, resembling the striped muscular fibre of animal life with nuclei. Were this positively so, it certainly would be a very important fact, but Prof. J. Henle of Göttingen, has in the last published portion of his Systematic Human Anatomy, shown that this transverse marking is very different from that of muscle of animal life, and is due to a very fine folding of the fibre caused by the action of the acetic acid, the same as is produced on fibres of connecting tissue. The zonula fibres are nearest allied to fibres of elastic tissue, yet differ from these in their reaction to acetic acid and potash. Finkbeiner thought he found striped muscular fibres in the zonula. Nuhn, as also Dr. Heiberg, found that a certain proportion of these fibres became striped from the action of the acetate of the oxide of lead and acetic acid, and thought therefore as others (Camper, Retzius) that they were muscular, although this could not be proved either chemically, or by electric irritation. Dr. Heiberg says, however, that he found these fibres in the horse's eye when fresh.

The following paper was read:

ON A CAT WITH SUPERNUMERARY DIGITS. BY BURT G. WILDER.

Instances are not very rare of cats having six toes upon the fore feet, but in this case, instead of *five*, one fore foot had *seven*, the other *six*, and each hinder foot *five* toes instead of four, the usual number.

The additions are all upon the radial and tibial borders of the hands and feet, so as to be extra thumbs and great-toes; but, though well formed and bearing both pads and claws, they do not seem to be under control of the animal, and though freely moveable at their attachment to the feet, yet the phalanges (at least two in number) of which they are composed, have little or no motion upon each other.

On the inner or tibial border of each hind foot is an extra digit which comes off about one inch and a half above the tip of the foot; it is small and closely resembles the thumb on the fore foot of ordinary cats. But in this individual, the thumbs, instead of being short and of little practical importance, are larger and longer than any other digit; on the left foot is a small supernumerary digit coming off like a bud from the ulnar border of the thumb, while on the right foot is a similar one, and in addition a second coming off from the radial border of the thumb.

The effect of these extra toes is to make the fore paw very large, like a hand with a thick mitten or glove; and this cat is certainly somewhat noted for her climbing powers, as well as for using her hands in other respects more effectively and dextrously than usual. Her three kittens possess the extra toe upon the hinder foot, but the thumbs, though larger than usual, are single.

It would be interesting to ascertain, by comparison of specimens, and published accounts of supernumerary digits, whether they occur more commonly on the anterior or posterior extremities, whether upon the right or left sides, and whether upon the inner or outer borders of the feet; this I have not yet had time to do, but the simple frequency of this kind of monstrosity is, in my opinion, an indication that only to a very slight extent, if at all, is the number of the digits themselves or that of their phalanges to be taken as a basis for morphological comparisons. The hands and the feet are the terminal segments of parts which are themselves comparatively teleological appendages of the anterior and posterior poles of the main axis of the vertebrate body, and are therefore as far as possible removed from the morphological centre of the body, which may reasonably be located at or near the middle of the vertebral column, where the ossification of the bodies, or centra of the vertebræ commences, and from which it advances forward and backward.

The question will arise whether such duplications are not similar in nature to those which result in more or less complete double monsters, and which are referred to a more or less complete coalescence of two more or less perfect individuals: in which case their occurrence would have no signification outside of the domain of Teratology. But if, as seems to me the case, such supernumerary parts at the distal extremities of the limbs are rather instances of simple vegetative repetition of elements whereof several normally exist in a series, as with the caudal vertebræ of the tailed mammalia,—then it is evidently unsafe to depend upon them for the determination of morphological problems.

It would be as reasonable to define the sacrum, from its position in man, as that compound bone behind which are only four coccygeal vertebræ, and then, in looking for its homologue in the cat, to commence at the tip of the tail and, not finding the fifth therefrom to be such a bone, to deny the existence of a sacrum in that species; or if this is an exaggeration, to compare two human spines, in one of which were four and the other five coccygeal vertebræ, and to conclude that in the latter was a misplacement of the sacrum rather than an unusual number of coccygeal elements: this, I say, would be as reasonable as to attempt to determine morphological relations by reference primarily to parts so far from the morphological centre, so subject to teleological modifications, and so liable to variation from vegetative repetition, as are the terminal segments of the limbs.

And yet almost invariably, not only in popular but in scientific comparisons between the fore and hind limbs of vertebrates, there is assumed at the outset a *parallelism* between them and a correspondence of the thumb with the great toe, and of the little finger with the little toe: no doubt these do correspond with each other, but this by analogy, not homology; the resemblance is teleological, not morphological, and depends upon external form and function as presented in the mammalia, rather than upon essential structure and the relations which they hold to other portions of the limbs, and to their homologues among the three lower classes of vertebrates: for though in mammalia the two digits which in men bear the names of thumb and great toe consist of only two phalanges, while all the others possess three, yet no such numerical relation exists among the birds, the reptiles and the fishes.

The philosophical method is that adopted by Professor Jeffries Wyman.* To begin our comparison by reference first to the proximal segments of the limbs, or still better, back to the main axis and to the outlets of the internal organs, which would suggest that between the two ends of the body is a certain *oppositeness* or *antagonism* or *polarity*, both morphological and teleological, similar to, though less obvious than, that which is so universally recognized between the right and left sides; and now in approaching the limbs we should find that "corresponding segments point and are flexed or extended in absolutely opposite though relatively similar directions."† At least this is the case till we reach the hands, and then, the forearm being in a state of supination, the ulna and radius are parallel and are seen to correspond with the tibia and fibula respectively: while the palm points downwards and forwards and the sole of the foot downwards and backwards. Having recognized all this we shall be less disturbed by the want of analogy between the thumb, which will become the outer digit of the hand, and the little toe, and shall be very loth to renounce the teachings of all parts between them and the morphological centre of the body for the sake of a mere teleological resemblance between the thumb and great toe: and we shall prefer to acknowledge our inability to solve the problem, and to wait patiently for more light upon the subject, rather than, with some, to utterly ignore the existence of any homology at all between the fore and hind limbs, or, with Vicq D' Azyr and Cuvier to regard the fore limb of one side as corresponding with the hind leg of the other; or with Cruveilhier, to consider that the upper end of the tibia is represented by the upper half of the ulna, and the lower half of the tibia by the lower half of the radius, the fibula being represented by the upper half of the radius and the lower half of the ulna; or with Prof. Owen to consider the prolongation of the fibula in the wombat to be the homotype of the olecranon, and the sesamoid bone developed in the tendon of the *biceps brachii* in certain bats, to be the homotype of the patella; or, still more unnaturally, with Prof. Martins,* to so persist in forcing a parallelism upon the limbs as to assume a *torsion* of the humerus for the existence of which even he offers no other evidence than his own desire therefor, and which, as has been pointed out by Prof. Humphrey,† would be in a direction opposite to that of the real torsion of the limb which takes place during development.

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* On anterior and posterior symmetry in the limbs of Mammalia. Proceedings Bost. Soc. Nat. Hist., June 6th, 1860.

† See my Memoir on Morphology and Teleology, page 20, in Memoirs Bost. Soc. of Nat. Hist., Vol. I., Part 1.

NOTE. This paper was read December 19th, 1865, and accidentally omitted from the record of that date.

For further remarks upon the views of Humphrey, of Martins, and of Foltz, who has compared the foot with the supinated hand by assuming the thumb and great toe to be *double*, and to correspond with the fourth and fifth toes, and fourth and fifth fingers, respectively (Homologie des Membres Pelviens et Thoraciques de l'Homme. Journal de la Physiologie de l'Homme et des Animaux, 1863, Vol. VI), see a paper on the Morphological value and relations of the Human Hand, read by me before the National Academy of Sciences, Aug. 8th, 1866.

Mr. W. H. Niles made a communication on the Echinoderm fauna of the Burlington Limestone of Iowa. Hitherto this Limestone had been considered to belong to one period, but his observations, made in connection with those of Mr.

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* Nouvelle comparison des Membres Pelviens et Thoraciques, Montpelier. Annales des Sciences Naturelles, Tom. viii, p. 45. 1857. Memoire sur l' Ostéologie comparèe des articulations du coude et du genou chez les mammifères, les oiseaux et les reptiles. Ann. des Sci. Nat. 1862.

† Observations on the Limbs of Vertebrate Animals, the plan of their construction, their homology, and the comparison of the fore and hind limbs, by Geo. M. Humphrey, M. D. London, 1860.

Charles Wachsmuth, showed that the formation should be divided into two. This division was indicated by a bed of chert two or three feet in thickness, above which no species of Crinoids from the lower beds passed. All the species in the upper were specifically distinct from those in the lower bed, being themselves larger and provided with larger nodes and spines. The Molluscan fauna of these beds was very scanty, though distinct in the two beds. He had found that the Crinoids were most largely developed in the Keokuk Limestone, which overlies the Burlington Limestone. This order of Echinoderms seemed to culminate in the Keokuk rocks.

Dr. J. C. White, on behalf of a Committee appointed to convey the thanks of the Society to Dr. H. Bryant for the donation of the Lafresnaye collection of birds, read a copy of the letter which had been sent to Dr. Bryant, communicating the action of the Society.

Dr. B. G. Wilder exhibited a yellow band of silk of the *Nephila plumipes*, a geometrical spider, which had been woven into the middle of a ribbon by a power loom. The thread consisted of many threads reeled directly from several living spiders at the same time, and doubled and twisted. The exact number of threads is not known, and the specimen was prepared and exhibited simply to show the entire practicability of reeling and weaving it.

He had found the bite of this spider to be entirely harmless, it having bitten a young kitten severely six times, drawing blood quite profusely. No ill effects were noticed after the immediate pain of the bite had passed away.

Dr. C. T. Jackson presented, in the name of the donor, two photographs, a front and a profile view, of M. Elie de Beaumont.

The following gentlemen were elected Resident Members: Prof. William Denton, Messrs. George Higginson, F. R. Sturgis, and John T. Jackson, of Boston.

June 6, 1866.

The President in the chair. Twenty-nine members present.

Mr. T. T. Bouvé gave some account of the minerals presented by Dr. C. T. Jackson this evening. The collection was a large and valuable one; many of them having been obtained in former years in localities now exhausted.

Mr. F. B. Sanborn read a letter from Mr. William B. Fletcher, presenting specimens and giving an account of the habits of a Darter, *Pœcilichthys cœrulea* of Storer, taken at Indianapolis, Indiana.

The following paper was presented:

ON THE FORMATION OF MOUNTAIN CHAINS. BY N. S. SHALER.

Nothing shows more clearly the imperfect nature of our knowledge of the forces which have brought about the existing condition of the earth's surface, than the doubt which still exists as to the cause of mountain chains. There have been many views brought forward, some of which seemed to satisfy most of the facts, but none have been sufficiently broad to include all the phenomena, and the most clearly defined result of the action of physical forces of the earth's crust still remains involved in obscurity. The main difficulty in the way of gaining an insight into the cause of all the dynamical phenomena of the earth's surface, is the doubt which has all along existed as to the physical condition of the mass of the earth. Until it is decided whether the sphere is rigid to the centre, or essentially fluid, with a crust floating upon its surface, it will scarcely be possible to attain to anything like certainty in our explanations of all the movements in the crust. Although in deference to the weight of opposing opinion, we must regard the question of fluidity or rigidity of the interior as still unsettled, there can remain little doubt in the minds of those geologists whose views are in no way influenced by the defence of long held opinions, that the earth is essentially rigid, and that the condition of mobility of the elements of the mass which perfect fusion gives, can not be the prevailing condition of the interior. The calculations of Hopkins* and Thompson† seem to make scarcely any other view possible, and the few investigations which have been made into the contraction of the igneous rocks in cooling, make it impossible to conceive how a solid crust formed on a fluid interior could be sustained, subjected as it has been to innumerable shocks, sufficient to rupture it, and sink the fragments in the fluid below. Against these facts we have to set those evidences of igneous action afforded by volcanoes and associated phenomena, and which have, not without reason, been supposed to give trustworthy evidence of a generally fluid condition of the interior. Fairly weighed, however, all that can be considered as proven by all the evidences we have is, that in that portion of the past history of the earth, of which we have record, there has existed a condition of igneous fluidity beneath a large part, if not the whole extent, of the surface. That this igneous fluidity extends to the centre, or even that it is of more than a very few miles in depth, are suppositions which derive no valid support from igneous phenomena. The increase of temperature as we go from the surface towards the centre, and the extreme elevation of heat which must exist at considerable depths, can not be regarded as evidence of the general fluidity, until it has been shown that the internal pressure has not a greater influence in preventing liquifaction, than internal heat in producing that condition. In the present state of knowledge, or rather ignorance, of the physical questions involved in this problem, the safest position is that which conflicts least with the conclusions derived from the cognate sciences of Astronomy and Physics. The former science protests that certain observed facts could not exist if the mass of the earth was essentially fluid, and that tried by tests far more unerring than any the geologist is able to apply, the conclusion is reached that our planet is at least as rigid as glass, and probably as rigid as steel. From the physicist we hear that all the known materials which have come to us from the earth's interior, contract in cooling, and that the general internal fluidity would cause any crust to shatter to pieces and fall in fragments into the fluid below, as soon as it had attained any such thickness as we know the crust to have. If we attach to these calculations the importance they deserve, we are forced to admit that the idea of the igneous fluidity of the interior is quite untenable.

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* Hopkins (Wm.) Phil. Trans. of the Royal Soc., 1836, p. 382.

† Thompson (W.) on the Rigidity of the Earth. Proceedings of the Royal Soc., Vol. XII. p. 103.

A much more satisfactory view than that just referred to, which will not conflict with the results of investigations in the exact sciences, may be attained by a brief consideration of the possible conditions of solidification of the cooling earth. If the effect of pressure in promoting solidification at the earth's centre were greater than the effect of heat in resisting solidification, then the mass would congeal first at the centre, and solidification extend thence towards the surface. If on the other hand, the effect of the pressure at the centre failed to overcome the tendency to liquefaction induced by the extreme heat of that point, then we must suppose that cooling went on until the whole mass was reduced to something like an equal temperature throughout, and the whole sphere become solid at once. During this process of cooling down, successive crusts might be formed, but they would necessarily be transient phenomena, breaking to pieces as soon as they began to attain considerable thickness.*

This last supposition seems to be excluded by the well known fact of the increase of temperature as we go from the surface towards the centre ; the rate of increase is such that we would attain a temperature sufficient to melt the most refractory substances in a few miles from the surface ; this is far from the state of things we would expect to find if the whole interior had been reduced to the temperature at which solidification could take place at the surface before any part became rigid. On this account we are driven to adopt the other view as the more probable, and regard the superficial portions as the last to become solid, and the centre as the first rigid portion of the earth.

As solidification advanced from the centre towards the surface, there would be a time when the remaining liquid matter was of inconsiderable thickness, that the surface might also begin to solidify, and the intervening igneous matter being in a state of viscous fluidity, might so far uphold the solid outer crust, that it would not break up and fall into the fluid below. The further solidification of the interior would then take place in two directions outward from the central nucleus, and inward from the outer crust. If, however, this residual fluid matter was confined, beneath, say, one hundred miles of crust, cooling would proceed with such extreme slowness, that a very great time might elapse before it became lost in the already solidified surfaces above and below. It is not impossible that to this insignificant relic of an original molten condition, we owe all the phenomena of igneous action which have affected the crust since the beginning of the geological record.

There seems no point of conflict between this conception and those conclusions of geologists which are supported by any considerable amount of evidence ; it only contravenes those hypotheses which have failed when subjected to critical examination, or which from their essentially undemonstrable character can not be either verified or disproven. At first sight it might seem difficult to account for the phenomena of corrugation of the earth's crust, as exhibited in the continental folds, and in mountain chains, if we reject the hypothesis of internal fluidity. The design of the present paper is to show some reasons for believing that both of these phenomena may be explained without the assumption of any thing more than the trifling amount of igneous fluidity involved in the hypotheses we have just discussed.

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* See the Preliminary Observations to the Paper of Hopkins above referred to, where these considerations will be found.

Without any particular examination of the facts, it seems to have been assumed by most geologists that all the phenomena of corrugation, whether exhibited in mountain ranges, or in continents, are to be regarded as effects of one and the same cause, differing only in magnitude. It is manifest that it is a matter of first importance in seeking an explanation of the origin of these phenomena, to determine whether this assumed identity of cause is true or no. If it be the fact that continental elevations and mountain elevations are but degrees of effect of the same cause, then there should be no other differences in the phenomena than those of magnitude, or of features dependent directly upon the magnitude of the areas involved in the disturbance; furthermore, there should be something like a series, at one extremity of which could be placed the greatest relief of continental fold and oceanic depression, and passing gradually to the most inconsiderable flexures. It requires no very careful examination to bring the observer to the conviction that those essential features do not exist. The phenomena observable in the two actions are not cognate. There can hardly be said to be any thing like a series or gradation connecting the whole assemblage of phenomena, and the inference seems strong that the cause is not the same in the two cases. We find, for instance, in continental folds, broad curves of the surface, which narrow without exception towards the south, and which exhibit in no part of their structure the evidences of powerful lateral thrust, which are the most conspicuous phenomena of mountain chains. In these latter, however, we perceive evidences of linear disruption of the crust, showing intense, but localized energy, with no tendency to increase of magnitude in any one direction. In the continents we behold curves of thousands of miles in diameter, showing an equal force acting throughout, in the mountain very powerful forces acting along one line, and inoperative a few tens of miles away. There seems nothing in common in the phenomena except that both are folds of the earth's surface. The great breadth, and comparatively gentle curves, characterizing the continental folds, show that a great thickness of material is involved in the movement; their gradual development in successive geological periods, together with what we know concerning the loss of heat from the interior of the earth renders it eminently probable that they arise from the accommodation of a hardened outer crust to a diminished nucleus. All the fluidity required in this view of the effect of the contraction of the mass upon the contour of the crust, is given by the hypothesis which claims that solidification began at the centre, and that all that remains in any sense liquid, is a very small portion comparatively near the surface.

While the contour of the continental folds, as exhibited both in land surface and sea floors, evinces the gradual operation of the general contraction of the earth on a crust of great thickness, we have in mountain chains another effect of contraction, which can not, from the evidence, be properly referred to the shrinking of the whole mass. It is evident that if the continental folds are compensative wrinkles formed in the adaptation of a crust to a diminished nucleus, the mountain chains can not be of the same nature; it is not to be believed that a crust would bend from the action of the same force into the broad, low curves of the continents, and into the sharp defined and narrow fractures of a mountain range.

Accepting, as established, the fact that mountain chains are the result of lateral pressure, and indirectly of contraction from loss of heat, and denying that they are the result of the accommodation of the crust to the nucleus, it is at once manifest that we must seek their origin in the changes going on within the crust itself, and in no way connected with the regions below. And within that crust we can find forces operating to produce contraction quite sufficient to account for all the facts.

According to the computations of Thompson,* we may assume that at the close of ten thousand years after solidification of the surface of the earth had taken place, the rate of increase in temperature would be 2° Fahrenheit, for each foot of descent, and with the lapse of time, the rate of increase in going towards the centre would be less and less rapid in about the proportion indicated in the table below.

10,000	years after freezing of	surface,	2°	Fah. for	each foot.†
40,000	“	“	1	“	“
160,000	“	“	$\frac{1}{2}$	“	“
4,000,000	“	“	$\frac{1}{10}$	“	“
100,000,000	“	“	$\frac{1}{50}$	“	“

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* Thompson (Wm.) on the secular cooling of the Earth. Trans. Roy. Soc., Edinburgh, XXIII, Sec. 1.

† The effect of these changes in temperature may be estimated from the following table of the expansion of various substances under the influence of heat:

For each degree of Fahrenheit,

Granite expands about	.000004825.
Marble “ “	.000005662.
Sandstone “ “	.000009532.

A stratum of granite five hundred miles in diameter would contract, on passing from a temperature of 3,000 degrees Fahrenheit to the average temperature of the earth, about seven and a half miles; in the case of a sandstone area of the same diameter, the contraction would amount to about fifteen miles.

The computations on which these estimates are founded were based on experiments made by Mr. H. C. Bartlett, of the United States Engineers, and published in the Amer. Jour. Science, Vol. XXII. p. 136. See also for other data on this point, Ninth Bridgewater Treatise, C. Babbage, 2d Edit., Appendix, p. 221.

If this calculation is correct, (and that it is in a general way correct, does not seem to admit of much doubt, provided we accept the hypothesis of original igneous fluidity,) it follows that the gradual cooling of the deeper portions of the crust must result in the formation of a strong lateral pressure at every point nearer the surface. The truth of this proposition is readily seen, when we consider that while the original surface, which in ten thousand years after the hardening of the crust had been reduced to the temperature of the atmosphere, retained the same temperature in the ages which followed, the portions of the crust beneath were constantly parting with their heat, and approaching nearer to the thermal condition of the surface. There would be no shrinkage of the surface layer from the loss of heat, while from this cause the contraction of the deeper portions would be considerable. This would give precisely the conditions requisite to produce a rending and upfolding of the superficial strata of the outer shell. Immediately after the formation of a crust, the progressive diminution of the interior heat would begin to produce a tension on the surface which would augment as the ceaseless flow of heat went on, until either a rupture of the contracting beds, or the folding together of the superficial layers, relieved the strain. Both these methods of accomplishing the movement of contraction, have been most probably operative at different times and places in the earth's history. Furthermore, as the upper portions of the crust, or region of slight contraction, is of much less thickness than the region which, by its considerable contraction, produced the tension, we would expect the fracture to take place on the surface, rather than below. There is one thing which could operate to prevent the certain contortion of the superficial portions of the crust, and that is the horizontal position of its beds; as ordinarily constituted, the resistance which the upper few miles of the crust could oppose to the action of any force tending to throw it into folds, is very great. When the contortion has once begun, and this resistance fairly overcome, all further changes would meet with comparatively little resistance.

We have spoken only of those cases where the original surface had continued to exist from the beginning, while the isogeothermals beneath them had gradually sunk deeper and deeper towards the centre of the earth. This being a very unlikely condition, it remains to be seen what would be the effect where the actions of denudation, or deposition, are going on. It is evident that whenever the rate of denudation was such that the removal of the crust took place with the same rapidity as the recession of the isogeothermals from the surface, there could be no lateral strain produced by the loss of heat. Where, on the other hand, rapid deposition of materials was taking place, and the isogeothermals, on that account, were rising towards the surface, there would also be no such strain on the upper part of the crust. It thus appears that the conditions of tension competent to produce mountain chains, would only be found strongly developed in regions where the rate of denudation was less than the rate of recession of the isogeothermal lines, or where the rate of deposition was not sufficiently rapid to prevent the recession of the lines of equal heat.

Accepting this hypothesis of the origin of mountain chains, it is at once seen that they should have their region of greatest development on the land surfaces, and seldom or never originate on the ocean floors. On the land areas we would expect to find them originating at those points where there were some forces operating to favor the displacement of the beds constituting the crust, from their normal position, for at such points the contracting force would most easily produce corrugations. The author has elsewhere given a brief notice of a view of the origin of continents, from the tendency of all regions where deposition is going on, viz., sea bottoms to subside.* This view, if correct, will warrant us in believing that shore lines are points where fracture and dislocation of the crust are likely to occur. The distribution of volcanic vents of the present day, and the instructive fact that volcanic outlets of former geological periods ceased to be active when left inland, in the progress of geological changes, would of themselves indicate a peculiar liability to rupture of the superficial portions of the crust along shore lines. Let us suppose that the recession of the isogeothermal lines had placed the superficial portion of the crust in a state of tension, which could only be relieved by the formation of mountain elevations, and that the laying down of sedimentary materials had, at the same time, prepared that portion of the crust beneath the ocean floor for subsidence, then the moment this latter action is effected, it is likely to bring about fractures along shore lines, attended by the escape of gaseous and igneous materials. This dislocation of the crust would be attended by the pushing together of the superficial portions from either side, and the resulting elevations might be complicated by the intrusion of a greater or less amount of igneous matter.

This view of the origin of mountain chains seems to be reconcilable with some of the most prominent features which are to be found in their structure and distribution. Their usual, if not invariable, origin along shore lines, the suddenness of their formation, the variable amount of igneous action exhibited in their masses, are explicable on this hypothesis. On the other hand, it is not to be denied that some considerable objections can be urged against it. In the first place, in order that any considerable elevation be formed by this action, it would be necessary to have the upper and lower beds slide one upon another, to a certain extent; but it is to be borne in mind that the power we are hypothecating is practically illimitable, since it would, by the supposition, continue to accumulate until the force became sufficiently great to overcome resistance. The sliding of beds upon each other under the influence of great lateral pressure from the contraction of the lower portions of the crust, has fewer objections to be urged against it, than the view which assigns the origin of mountain chains to the passage of great waves of translation through the crust, and their fixation by the intrusion of molten matter.

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* See these Proceedings, Vol. x. page 237.

It is scarcely necessary for the author to state, that no claim whatever is meant to be made in this paper, to the hypothesis of the origin of the features of corrugation of the crust from the influence of contraction from loss of heat; one of the oldest and most generally accepted theories of the science. It having been denied by very high authority that there existed any cause competent to produce lateral thrust, and thus to originate mountain chains, it has seemed desirable to direct attention to the fact that the recession of the isogeothermals would be attended by such lateral strain.

The points which have been suggested in the foregoing considerations, may be briefly summed up as follows:

1. That the most probable hypothesis in the present state of our knowledge of the earth, is, that it consists of an immense solid nucleus, a hardened outer crust, and an intermediate region of comparatively slight depth, in an imperfect state of igneous fusion.

2. That the continental folds are probably corrugations of the whole thickness of the crust.

3. That mountain chains are only folds of the outer portion of the crust caused by the contraction of the lower regions of the outer shell.

4. That the subsidence of ocean floors would, by producing fractures and dislocations along shore lines, tend to originate mountain chains along sea borders, and approximately parallel to them.

June 20, 1866.

The President in the chair. Twenty-seven members present.

Before proceeding to the ordinary business of the meeting, the President stated that the Society had recently lost two of its members by death, Prof. Henry D. Rogers of Glasgow, Scotland, and Mr. William Glen of Cambridge, and made some brief remarks on their scientific services.

Prof. H. James-Clark stated that he had lately been engaged upon an investigation of the nature of *Sponges*, and that he had not only fully confirmed the belief of some previous observers that they were truly animals, but that he was now able also to say that their exact classificatory relationship was with *Infusoria Flagellata*, and not with *Rhizopoda*, as Carter and others have claimed.

He showed by a series of diagrams that they are intimately and inseparably linked with the *Infusoria Flagellata*, such as *Monas*, *Anthophysa*, *Astasia* and *Anisonema*, and more particularly allied to certain new genera which he characterised and named, as he proceeded to intercalate them in their proper positions among the genera just mentioned. The genus *Monas* he restricted to such forms as have a normally pedicellated, contractile body, furnished with a more or less elongate or conical, prehensile lip, and a closely juxtaposed, arcuate *flagellum*, with a highly distensible mouth lying between them. The contractile vesicle is a globular organ which pulsates with varying rapidity according to the species to which it belongs, but always with a very abrupt systole.

Bicosœca, nov. gen., might be designated, in general terms, as a *Monas* attached to the bottom of a usually pedicellated calyx by a highly muscular, spasmodically retractile cord. Its lip and arcuate flagellum are attached to opposite edges of the front, and the mouth lies intermediate. The contractile vesicle is single or double, and situated at various parts of the body, according to the species. One marine and one fresh-water species.

Codonœca, nov. gen., unlike *Dinobryon*, has no lip, nor eye-spot, but possesses a strictly terminal flagellum like *Peranema* Duj., and a flexible contractile body, which is seated loosely in a calyx. The contractile vesicles are two in number, and lie — at least in the only species observed — on opposite sides of the middle of the body.

Codosiga, nov. gen., has a contractile, pedicellated body; a centrally terminal, arcuate flagellum; a highly flexible and contractile, hollow, membranous cylinder, or collar, which projects from the front, and encompasses the area about the mouth and base of the flagellum; two, or perhaps three, slowly pulsating, contractile vesicles, usually lying on opposite sides of the body, and not far from the posterior end.

Lives in colonies of from two to several, the bodies attached to the forked terminations of a single stem.

Salpingœca, nov. gen., is in general terms, a stemless *Codosiga*, seated loosely in a variously shaped calyx; the former bearing a similar relation to the latter that *Cothurnia* does to *Epistylis*. Three species to be described in a forthcoming memoir.

Leucosolenia botryoides Bowerbank. This species of *sponge* formed the principal object of investigation in the group to which it belongs, and drawing an inference from it the conclusion was reached that all the true ciliated sponges are *flagellate Protozoa*. In the present instance the "*monociliated sponge-cells*," as they are called by Carter, are so closely allied to *Codosiga*, in every point of structure, that one might rightly designate the *Leucosolenia* as a horde of the stemless monads of *Codosiga* closely packed together, with their posterior ends imbedded in a gelatiniform, spiculiferous mass. Each monad possesses a very long *flagellum*, which arises from the centre of the broad frontal area that is enclosed by the low, cylindrical, extremely delicate membranous collar, and is endowed with two distinct, but juxtaposed contractile vesicles.

Anthophysa Bory, has a prehensile lip, like *Monas;* two *flagella*, of which one is long, stout and arcuate, and the other—attached close to the base of the first—very short and delicate; a mouth opening between the lip and the *flagella;* and a contractile vesicle lying (in *A. Mülleri* Bory) at the middle of the body.

Mr. W. T. Brigham gave some account of recent investigations on the volcanoes of the Hawaiian Islands, exhibiting and presenting a very extensive series of lavas gathered from the different flows, especially of the successive eruptions of the volcano Kilauea, which were found to vary greatly, both in their physical and chemical characters. He showed stalagmites formed in a cave heated by steam, where the lava had dissolved on the roof of the cave, forming long pendants.

The following paper was read:—

DESCRIPTION OF SALPA CABOTTI *Desor*. BY ALEX. AGASSIZ.

The Salpa here described is quite common south of Cape Cod in Vineyard Sound, Buzzard's Bay, and Long Island Sound. I suppose it to be the species named by Desor, *Salpa Cabotti*, mentioned in the third volume of the Proceedings of the Boston Society of Natural

History. As he has given no description, either of the chain or solitary form, it may not be out of place to describe our species, and point out its relations to other known species. The chains and solitary individuals make their appearance during the end of July, and have been found from that time till the end of October. The chains move along with the current, seemingly quite helpless, though the upper extremity is sometimes deflected somewhat abruptly by attempts to escape capture. The solitary individuals, on the contrary, are exceedingly active, swimming about vigorously, generally with the anterior extremity uppermost; expelling (through the posterior extremity) by quick and powerful jerks the water which propels them by its reaction. Their motions are very similar to those of *Trachynema* (*Circe*); they can readily change the direction of their movements, and regulate them by their powerful transverse muscular bands, though they lack in their motions the ease and grace of Jelly Fishes.

In describing this *Salpa*, the side on which the heart is placed has been called the dorsal; the opposite, on which the nervous ganglion is found, the ventral, while the anterior and posterior extremity correspond to the openings through which the water is introduced into the body, and expelled from it, thus homologizing the Salpa completely with the fixed Ascidians to which they are so closely related. The proles solitaria of the *Salpa Cabotti* Des. (figs. 1–3) resembles that of the *Salpa spinosa* Ott., figured by Sars in his Fauna Littoralis, but differs from it materially, as the subsequent observations will show. The body is transparent, almost colorless, perfectly smooth, with the slightest possible tinge of pink, increasing in intensity towards the posterior extremity; the nucleus is of a deep chesnut color. The general outline of the body when seen from the dorsal (fig. 1), or from the ventral side (fig. 2), is barrel-shaped, with a uniform curvature at both ends. The posterior extremity terminating in two long conical processes (*p.p.*) with a coecum of the respiratory cavity (*c.c.*) at the base (fig. 1). When seen in profile (fig. 3), it is truncated abruptly at the two ends, from the ventral to the dorsal side; the extremities are slightly convex; the posterior truncating plane is more inclined than the anterior, and as the dorsal side is at the same time somewhat convex, this gives the anterior end a slightly pointed appearance. Besides the two large posterior conical processes, there are two sharp lateral ones, quite small (*l. p.*), and seen only from the ventral side (fig. 2) on each side of the termination of the respiratory cavity, and two other short processes (*o. p.*) situated on the median line (fig. 2) at the posterior extremity of the body, placed one above the other (figs. 1 and 3), the larger process is situated nearest the posterior opening. These processes, like the surface of the body, are quite smooth. There are six muscular bands entirely encircling the body;

the second, third and fourth, (beginning at the anterior extremity), unite on the ventral side, while on the dorsal side the muscular bands are nearly equidistant. (See fig. 1). The anterior opening for the admission of water is by far the largest of the two openings of the respiratory cavity; it occupies the whole width of the body (figs. 1–2), while the posterior one, through which the water is expelled is much narrower, and placed at a short distance from the posterior extremity, at the base of the truncating plane, on the ventral side, the anterior opening (*a.*) being nearer the dorsal side. The lips which close these openings are quite prominent, and can be thrown out considerably beyond the general outline, either when drawing in water, or forcing it out; the lips of the anterior aperture open dorsally, those of the other end open in the opposite direction (*b.*) when in action. (Fig. 3).

The external and internal tunics are well defined; hollowed out from this internal tunic arise the circulating veins; the larger ones are especially apparent at the point where the muscular bands are imbedded in this tunic. The gill (*g.*) runs nearly parallel with the ventral surface, in the shape of a thick, hollow column, wider at the posterior extremity; it communicates dorsally and ventrally with the circulating system, and is strongly ribbed on the back and sides with bands of cilia. At the anterior end of this gill is placed the languet (*l.*), a long grooved conical process slightly *s*-shaped, extending to the dorsal side of the respiratory cavity, and hanging freely within it, attached by a broad base to the ventral side of the cavity; the base of attachment is formed by a widening of the foot of the languet, where we find the ciliated fossa (*c. f.*) The large triangular area (figs. 1 and 2) within which the languet is placed, extends from the anterior end of the gill, and the vibratile cord (*c. b.*) which defines this vibratile cavity, as the area is called, encircles completely the anterior extremity of the respiratory system, and occupies about one quarter of the length of the body. At the angle made by the vibratile band, forming the edge of this cavity, where the cord takes a dorsal direction, is placed the nervous ganglion (*n. g.*), immediately behind the base of the languet; the ganglion is quite prominent, and sends numerous branches to the walls of the body. A large vesicle attached to the ganglion contains three irregularly shaped calcareous bodies, with deep black pigment spots on the exterior side, making the nucleus a most prominent object at the bottom of the ciliated cavity. The endostyle (*e.*) occupies nearly two-thirds of the length of the body. The heart (*h.*) is very prominent; it is placed slightly to one side of the median line, above the nucleus.

Surrounding the nucleus (*n.*) is found a chain of diminutive Salpæ, (*ch.*) extending in a circle from the right side of the nucleus on the upper side to the opposite side, then running under it, and coming out on the opposite side again, and stretching towards the median line. The young Salpæ are all attached by the posterior extremity, exactly as we find colonies of fixed Ascidians and Bryozoans, to a tube, (*g. t.*) which is a simple diverticulum of the circulatory system, and freely communicating with the gemmiferous tube as it is called. The young Salpæ are not uniformly developed in proportion to their distance from the base of the tube. Sections of the tube are equally advanced, and we find generally three such portions unequally developed, as has been noticed by Sars, Krohn, Huxley and others. The base of the gemmiferous tube is simply slightly corrugated, next comes a section in which we find two rows of slight elevations, and finally the most advanced part of the chain where the rudimentary Salpæ are more or less advanced, and resemble in every respect, long before it becomes detached, the chains which are found floating about. These sections are thus liberated in turn, new ones continually forming at the base of the gemmiferous tubes during the budding season. The part of the chain which is the most advanced occupies, however, so much of the tube that the other sections are scarcely noticed. These chains escape through an opening formed at the proper time through the tunic, near the nucleus, on the ventral side, which shows afterwards no trace of the passage of the small chain. When the solitary Salpæ are kept in confinement for any length of time, nothing is more common than to find floating about diminutive Salpæ chains, nearly identical in every respect, except size, with the larger chains found at the same time in the sea. These small chains usually consist of from twenty to twenty-eight pairs; they increase rapidly in size, as we find them of all sizes during every month in which Salpæ have been noticed, from the chains just escaped to the largest, which have already lost their solitary embryo. The mouth is placed beneath the heart, at the upper extremity of the posterior part of the gill; it opens into a kind of œsophagus, and the winding course of the digestive cavity can readily be followed in specimens which have lost the chain of Salpæ; the anus opens close behind the mouth in the respiratory cavity. The pyriform tubes first noticed by Huxley, are readily seen in the solitary specimens, though they are more plainly observed, as well as the eleoblast, in the aggregate form, just after their escape from the solitary Salpæ.

The principal difference between the solitary and aggregate forms is one of outline, and in the proportion of the different organs, which are essentially the same, except the organs of reproduction. The individuals of the chains are all alike on one side, that is, we find the endostyle either slightly to the right or to the left of the median line, according as the individuals are on the right or left row of the chain.

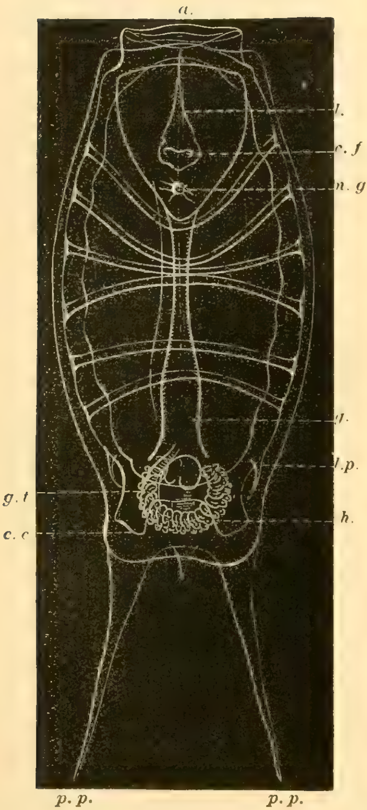
When seen from above or below, the aggregate form has not the regular barrel shape so characteristic of the solitary *Salpa;* it is more spindle-shaped with two somewhat ill-defined conical projections at the posterior extremity, into one of which the nucleus projects, and into the other a spur of the posterior cavity coming close to the surface, one of the eight spurs by which the respiratory cavities of adjoining individuals are connected. Each individual is in direct communication with no less than three adjoining ones, as will be seen hereafter. When seen in profile, (fig. 4), the outline is ellipsoidal; the two principal openings are placed at a distance from the extremities, the anterior spur of the tunic extending beyond the opening, thus bringing both their openings rather more to the ventral side, and not strictly along the continuation of the axis, but on each side of it. There are only five muscular bands, one at the posterior extremity, three others uniting on the ventral surface, somewhat behind the anterior part of the gill, and another ill-defined one at the anterior extremity. The nucleus (*n.*) is much larger in proportion to the body than in the solitary form; the endostyle (*e.*) occupies but a little more than a third of the cavity. The gill, when seen in profile, runs somewhat obliquely towards the anterior extremity, where it is nearest the ventral surface. There is no perceptible difference in the size of the anterior and posterior openings of the respiratory cavity. The vibratile cavity and the nervous ganglion do not differ in structure from those of the solitary form; the languet is perhaps somewhat broader and more powerful. In the chains I have had the opportunity to examine, I found either that the solitary fœtus had already been expelled, or was only slightly developed, so that I can only say that its position corresponds with what has been described by Sars, Krohn, Vogt and others, the testes, as is well known, being greatly developed in the individuals which had already lost their solitary fœtus. What is worthy of special notice in the aggregate form is the great thickness of the tunic; this would make the connection between the individuals of a chain simply a mechanical one, were it not for the spurs from the respiratory cavity (*s. c.*) which project through the thickness and connect with similar spurs in adjoining individuals. The spurs disappear invariably after the individuals of a chain have become separated for any length of time, and they are incapable of reuniting again as has erroneously been asserted. When thus freed, the aggregate form is perfectly helpless, the great thickness of the tunic preventing it from regulating its motion; while, when connected as a chain, their capacity to guide the chain in any particular direction is much greater.

Sars has described exceedingly well the mode of aggregation of the chain of *Salpa runcinnata;* the chains, however, were quite far advanced, and he found it impossible to trace distinctly their mode of junction. Soon after the chain escapes from the solitary form, while still quite small, so that four or five individuals can be brought under the focus at once, their peculiar arrangement is readily understood. The chain (fig. 5) consists of two rows of individuals placed slightly obliquely to the axis of the chain, in addition to the natural obliquity of the individuals on the right and left sides. The ventral side is always turned outside, and the individuals are placed therefore back to back at an angle measured by the obliquity of the endostyles, which is quite considerable. Besides this oblique arrangement of the ventral and dorsal sides, the anterior and posterior extremities are not on the same level; the anterior extremity is tilted up so that all the anterior openings are brought to the upper side of the chain when it is floating, and the posterior openings close to the edge on the lower side; the anterior opening is placed at a short distance from the edge of the chain, thus bringing, by this arrangement, the anterior and posterior openings on different sides of the chain. Adjoining individuals are connected by the two large dorsal spurs of the anterior extremity of the respiratory cavity. The next pair of individuals lap over the first pair of the chain very considerably, so far that the nucleus of the first pair is just below the nervous ganglion of the second pair. The right individual of the anterior pair is connected with the individual immediately behind it by the small spur of the respiratory cavity placed above the heart, and the large spur behind the nucleus, while it (the right hand individual of the second pair) connects with its adjoining fellow in the same way as in the anterior pair, and with the left anterior one by means of the two small dorsal spurs of the latter, and so on, for each succeeding pair, so that every individual of the chain is always connected by spurs to the three immediately surrounding it, in front, on the side and behind.

As far as I have noticed, the chains remain connected till they are full grown, although the breaking up of the chain from any cause does not prevent the components from living for a short time, yet the chain, as a whole, is by far more active than the separate components when free. The largest chains I have seen are somewhat over a foot in length; in these the individuals measured about five-eighths of an inch in length. This is much smaller than the solitary forms, which attain a length of an inch. Sars and Krohn were the first to repeat the observations of Chamisso concerning the connection of the solitary and aggregate forms, and they have clearly shown that the solitary form is asexual, always producing by budding a chain of Salpæ which are the sexual forms, and bring forth but a single embryo developed from an egg, giving rise to the solitary form. Huxley, Leuckart, and Vogt, have also since shown the entire accuracy

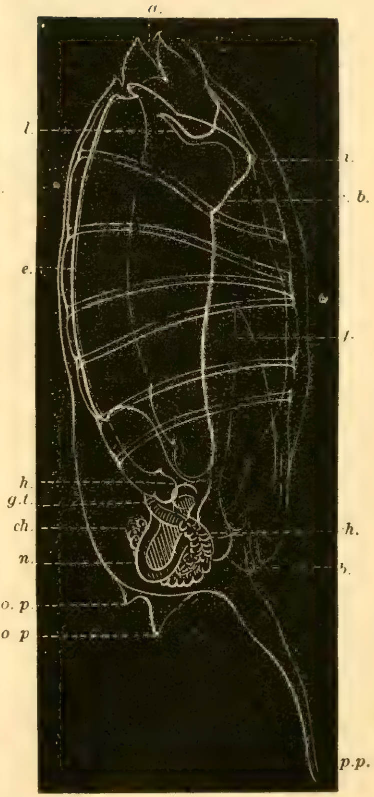
CENTRAL PARK
NEW YORK.

Fig. 2.



a.
l.
c. f
n. g.
g.
l.p.
g. t
h.
c. c
p. p.
p. p.

Fig. 3.



a.
l.
i.
b.
e.
f.
h.
g.t.
ch.
h.
n.
b.
o. p.
o p
p.p.

Fig. 4.

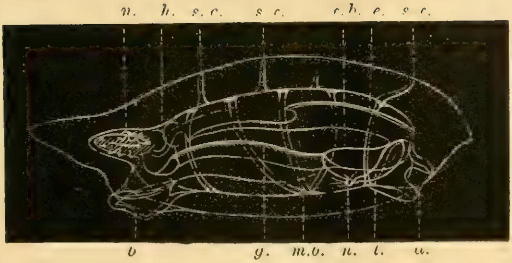
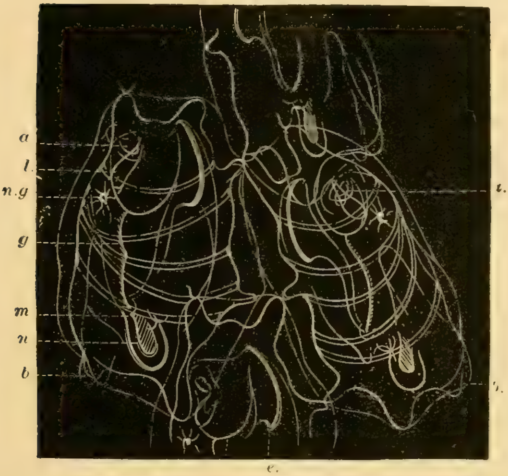

n.
h.
s.c.
s.c.
c.b.
e.
s.c.
b
g.
m.o.
n.
t.
a.

Fig. 5.


a
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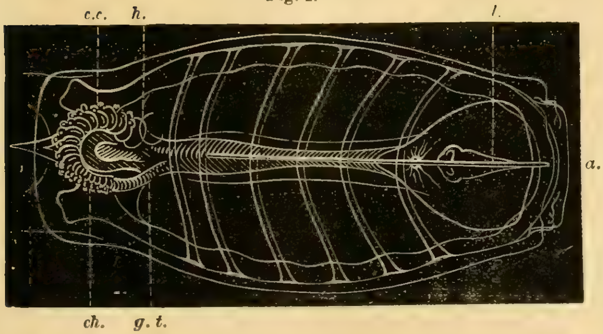
e.

Fig. 1.



of the observations of Chamisso, and have greatly increased our knowledge of the organization and development of these animals. The observations I have made concerning the early development of the chain and the solitary embryo, are too fragmentary for publication, and I am induced to give this description of our Salpa in hopes of calling attention to its existence on our coasts, and inducing those who are more favorably situated than I am to develope further this interesting subject. I would also add that this Salpa is not the only free Tunicate frequenting our coasts; two species of *Appendicularia* are extremely common, which have thus far escaped the attention of zoölogists; they are closely allied to *A. furcata* and *A. longicauda;* they both occur in Massachusetts Bay and Long Island Sound, while the *Salpa Cabotti* has not as yet been found further north than Nantucket.

EXPLANATION OF FIGURES AND LETTERING.

a. Anterior opening.
b. Posterior opening.
e. Endostyle.
n. g. Nervous ganglion.
c. f. Ciliated fossa.
c. b. Ciliated band.
ch. Small Salpa chain within solitary form.
g. Gill.
l. Languet.
h. Heart.
n. Nucleus.
g. t. Gemmiferous tube.
m. b. Muscular bands.
c. c. Cœcum of respiratory cavity.
s. c. Connecting spurs of respiratory cavity.
m. Mouth.
o. p. Odd terminal processes on median line.
l. p. Lateral processes of ventral side.
p. p. Pair of terminal processes of posterior extremity.
Fig. 1. Solitary form, from the dorsal side.
Fig. 2. Solitary form, seen from the ventral side.
Fig. 3. Solitary form, seen in profile.
Fig. 4. Three quarter-view of the aggregate form.
Fig. 5. Part of chain of Salpa Cabotti to show the arrangement and connection of the components.

Dr. A. A. Gould remarked on the habits of the Teredo, or ship worm, which he had found about our ship-yards and in buoys and lobster nets in the harbor. He had discovered several species belonging to two genera, and pointed out their generic and specific differences, illustrating his remarks by drawings; he hoped at some future time to present for publication detailed statements of their structure.

The following letters, which had been received since the previous announcement, were read:—

From the Académie Royale des Sciences à Amsterdam, October 8th, 1864; K. Hof- und Staats-Bibliothek, München, September 15th, 1865; Zoologisch-Mineralogischer Verein, Regensburg, November 30th, 1865; Utrecht Society of Arts and Sciences, September 29th, 1865; Naturforschender Verein in Brünn, September 1st, 1865; Lyceum of Natural History, New York, March 5th, 1866; and the Museum of Comparative Zoölogy at Harvard College, February 26th, 1866, acknowledging the receipt of the Society's publications. From the K. Bayerische Akademie der Wissenschaften, München, November 20th, 1865; Naturforschende Gesellschaft, Freiburg, October 24th, 1865; Naturhistorischer Verein in Augsburg, October 14th, 1865; St. Gallische naturwissenschaftliche Gesellschaft, October, 1865; Verein für Naturkunde im Herzogthum Nassau, Wiesbaden, October 10th, 1865; and the K. Bayerische botanische Gesellschaft, Regensburg, November 30th, 1865, acknowledging the same and presenting their own publications. From the Physikalisch-Medicinische Gesellschaft in Wurzburg, November 1st, 1865, the same, and regretting their inability to supply deficient parts of their publications. From the Utrecht Society of Arts and Sciences, October 1st, 1865; Kongl. Svenska Vetenskaps Akademien i Stockholm, November 17th, 1865; Académie Royale des Sciences à Amsterdam, June 26th, 1865; Academia Lugduno-Batavæ, November 6th, 1865; and the Académie Royale de Belgique, August 15th, 1865, presenting their various publications. From the Naturforschender Verein in Brünn, September 1st, 1865; the same, July 1st, 1864, presenting their publications and desiring an exchange. From the Société Hollandaise des Sciences à Harlem, January 30th, 1866, agreeing to an exchange of publications, and asking for a full set of the Society's publications. From the Præfectus Bibliothecæ Universitatis Lugduno-Batavæ, September 28th, 1865, acknowledging the receipt of the Society's publications, and asking for deficient volumes. From James C. Parkinson, M. D., Burlington, N. J., February 26th, 1866, offering for sale a collection of shells; and from H. Behr, M. D., San Francisco, January 26th, 1866, acknowledging his election as a Corresponding Member.

Dr. J. Wyman gave an account of the dissection of a young domestic pigeon, which was taken from the nest and was still covered with down.

The crop was found very largely distended with "canker worms," (larvæ of *Anisopteryx pometaria*). These weighed 33 grammes, the whole weight of the body being 110 grammes, after the crop was emptied. Twenty "canker worms" were found to weigh 1 gramme, which would give 660 as the number contained in the crop at one time, a mass nearly equal to one third of the weight of the young bird. The contents of the crop had an intensely acid smell, like that of a stomach in which digestion is going on, and many of the worms appeared to be nearly digested, their empty skins alone being left. The gizzard contained only a few empty skins, some husks of oats, and some stones, which last the bird must have received from its parent with the food, as it was wholly out of the reach of them from any other source.

It would appear from the above facts, 1st, that the pigeons are very large consumers of the pests mentioned above, and 2d, that the crop is probably the place where they are digested. If this last supposition should prove true, the gastric juice must pass upwards from the proventriculus to reach the crop.

Dr. J. Burnstell of Newton, and Mr. C. P. Dillaway of Roxbury, were elected Resident Members.

Special Meeting, September 17, 1866.

The President in the chair. Fourteen members present.

The President announced in a few appropriate remarks the sudden loss which the Society had recently sustained in the death of one of its founders and Vice Presidents, Dr. Augustus A. Gould.

Mr. C. K. Dillaway moved that a committee of three, consisting of the President as chairman and two other members selected by him, be appointed to report a suitable address to be laid before the Society at a subsequent meeting; being seconded by Dr. J. C. White, it was unanimously voted, and Messrs. T. T. Bouvé and S. H. Scudder were subsequently selected.

Dr. J. C. White moved, and it was unanimously voted, that the Society attend the funeral of its lamented Vice President.

On motion of Dr. H. W. Williams it was voted that four members of the Society, of which the President should be one, be nominated by the President to act as pall-bearers in connection with those appointed by the Suffolk District Medical Society. The President selected Dr. C. T. Jackson, and Messrs. Geo. B. Emerson and C. K. Dillaway.

September 19, 1866.

The President in the chair. Fifty-four members present.

On behalf of a committee appointed at the previous special meeting, the President read the following notice:

Dr. Augustus Addison Gould, for many years one of the Vice Presidents of this Society, died at his house on the morning of the 15th day of September. By this sad and sudden event, the Society loses one of its most honored and respected associates, and science a disinterested and truthful worker. From the beginning of our existence to the day on which he died, his hand was never weary in our service. Through many years we have leaned upon his wise counsel; his thought and labor more than those of any other have helped us in our progress, and it is to his name and fame, at home and abroad, that we are very largely indebted for what we most prize in our own. It is not we alone that suffer from his death. His interests were broad and catholic, and embraced whatever was good and excellent, and his helping hand was not withheld whenever sought, whether in behalf of the interests of science, education or humanity. The loss to these will be truly great. For all his disinterestedness, he was not without his reward. The profession of which he was so distinguished an ornament gladly bestowed upon him its highest gifts, and the community of which he was so worthy a member, gave love and honor for his many graces of character, and for his walk in life, so full of Christian excellence. With head and hand still busy, and with a heart still earnest in his chosen work, and still warm in all his relations to friends and kindred, it was God's will that he should pass away. The Society would express its gratitude for the example of his life, and offer its deepest sympathy to those to whose hearts his death brings so much sorrow.

Dr. Wyman announced that the Committee would present at some future time an extended notice of the scientific labors of Dr. Gould.

Dr. C. T. Jackson, from an intimate knowledge of Dr. Gould, spoke of the worth of his character, passed in review the various stages of his scientific career, expressed his belief that the Society had lost one of its most useful members, and science one of her most eminent followers, and moved that the address be accepted, placed upon record, and a copy furnished to the family of the deceased, which was unanimously voted.

It was also voted that a copy of the notice of the Committee be furnished to the press, after which out of respect to the memory of our lamented friend and associate, the Society adjourned without the transaction of business, or the hearing of scientific papers.

October 3, 1866.

The President in the chair. Thirty-nine members present.

In the absence of the Secretary, Dr. J. C. White was appointed Secretary *pro tempore.*

The following paper was read:

NOTES ON THE POSITION AND CHARACTER OF SOME GLACIAL BEDS CONTAINING FOSSILS, AT GLOUCESTER, MASS. BY N. S. SHALER.

The seaboard of New England, south of the Merrimac River, affords but few localities from which fossils laid down in the Drift Period can be obtained. On this account it is important that any beds which afford materials for a history of the life of that period along our shores should be brought to the attention of geologists, in order that a full exploration of their contents may be made. In the following notes, the author desires to direct attention to a point within easy access of members of this Society, which he is confident will, if properly worked over, afford a great deal of information concerning the distribution of life during the first stages of the last glacial period.

The beds in question are exposed by a shore section in the town of Gloucester, Mass., at a point about three hundred yards south of the Pavilion Hotel, and between that building and a small earthwork battery known as Stage Fort. The greatest height of the cliff face is about twenty-five feet. Throughout nearly the whole extent of the section, which is about two hundred yards in length, the base of the beds is hidden beneath the drift matter which covers the beach; at the southern extremity, however, adjacent to Stage Fort, the syenite which constitutes the mass of Cape Ann, rises above the sea level, and shows very plainly the contact of the base of the drift section with the bed rock.

Passing from the lowest portion of the section towards the summit, we find first a close grained, much indurated sand, with no distinct lines of bedding but splitting horizontally into thin layers. The structure of the material is such that it can hardly be described as a sandstone, though it is much harder than ordinary sands which have acquired compactness by their own weight without the influence of other metamorphic action. The physical condition of the mass is that of a very fine sand mixed with considerable clay. There is no general admixture of pebbles, but occasionally worn fragments of rock of a different character from any recognized in the superficial drift of the vicinity, are found scattered through the fine material. None of these were found above the size of a billiard ball, and they are so infrequent that often several cubic feet of the material may be searched through without finding more than one or two specimens. All the pebbles examined seemed to be of a true glacial character, little, if at all, affected by shore wearing. This character of material continues to a point about ten feet above high water mark, where, without any change in the general structure, some thin layers of a more clayey texture than the main mass are intercalated, in which, and for a little distance above and below, all the fossils which were found were imbedded. Above this point the same general structure continued to a height at the most elevated point of about eighteen feet above high water mark. Capping this bed with a tolerably distinct line of demarkation is a mass of the ordinary semistratified pebble drift, such as is found all over this section below the level of one hundred feet.

A glance at the whole length of the section shows the interesting fact that the upper surface of the lower, or fossil bed, is exceedingly irregular, sinking downward, passing out of the exposed section towards the northern extremity of the cliff. At other points in the section, irregularities of surface, such as could hardly originate beneath the level of the sea, are found, nor does it seem possible that they are to be attributed to land slides, or other confusing agents.

The syenite bed-rock, which is bared at the southern end of the section, exhibits unquestionable proof of ice-wearing, being thoroughly polished. The exposed surface being small, it is not possible to decide whether the striation is uniform in direction, and thereby to determine whether the agent which effected the wearing was land-ice, or iceberg. However this be, there is no doubt that the whole extent of the section rests on a true ice-ground surface.

The record of changes, as given by these beds, seems to admit of but one interpretation. The first condition there recorded is that of glaciation, during which the bed-rock received its smoothing; following this came a period of comparative repose, during which the deposition of the fine sediment constituting the fossil bed began. A conclusion based on negative evidence is always dangerous, but from the examination which has been made it would seem as if at first the sea-floor was quite barren of life, and that many feet of the accumulation had taken place before the life, which we find recorded in the fossils there found, had gained a footing on the bottom. After the accumulation of the fossil bed, there must have been an elevation of the sea bottom sufficiently extensive to bring the present summit of this bed above the water level. This elevation admitted of the formation of the irregularities of surface of the fossil bed from weathering actions. It does not seem likely that this elevated condition could have been long continued, for in the soft state of the material constituting the beds, degradation would have gone on very rapidly, and a comparatively brief period would have caused the destruction of the whole mass.

The next stage of the conditions seems to have been brought about by the subsidence of beds for the second time, so that the highest point of the fossil bed must have been many feet under water. It would seem from the section that this subsidence was immediately followed, if not attended, by the deposition of the ordinary stratified drift which borders the New England coast. For if any considerable time had elapsed between the depression of the shore and the laying down of the boulder drift, it is likely that there would have been some fine sediment laid down upon the weather worn surface, which is manifestly not the case.

It is most probable that the subsidence was accompanied by the deposition of the boulder drift, and that the subsidence went on until the beds were depressed to about one hundred feet below the present water line, this being the amount of sinking indicated by the upper level of the stratified drift material at other points in this region.

The most interesting feature in the evidence afforded by these beds is the fact that the physical conditions during that time denoted by the term Drift Period, were far from uniform, thereby showing that the division of the glacial epoch into several stages, which has been pointed out by Jameson and others, from the evidence found in European drift, is to be recognized also in American deposits of the same period.

About one hundred specimens were procured; the most of these were well preserved fragments; several quite perfect specimens were found, and there is no doubt that careful digging will furnish individuals of all the species occurring in the beds in a satisfactory state for determination of the species.

The author has hesitated in attempting to give a list of species from his imperfect collection, as this work should be deferred until ample materials have been accumulated. The following brief list will give some idea of the character of the remains imbedded in the section examined.

Leda. Two specimens.
Modiola discrepans Say. Several specimens.
Mya truncata Linn.? " "
Mesodesma arctata? Very doubtful.
Nucula sapotilla?
Panopea arctica Gould?
Saxicava distorta Say.
Five or six specimens of Lamellibranchiata not identified.
Crustacean remains, plentiful but very fragmentary.

Dr. Charles T. Jackson read the following

NOTE ON THE OCCURRENCE OF GOLD WITH CINNABAR IN THE SECONDARY OR TERTIARY ROCKS. BY WILLIAM P. BLAKE.

Since noticing in a general way the association of gold with cinnabar in the modern strata of the Coast Mountains of this State,* I have received some interesting illustrative specimens from Colusa Co.† In these, native gold exists in visible grains, implanted in the midst of cinnabar in a gangue of calc spar. The whole forms a thin seam or vein in a homogeneous bluish colored sandstone, somewhat pyritiferous, though otherwise but slightly altered from its original granular state. Samples of pebbles of cinnabar from the same place, obtained by placer washing, contain grains of gold.* The age of the formation is either Cretaceous or Tertiary. Fossils of the genera *Terebratula* and *Inoceramus* are abundant in the vicinity. The occurrence of gold with the quicksilver ore of New Almaden has been noticed by Prof. Oxland, who discovered it in the refuse of the furnaces;† he also notes its occurrence with the cinnabars of Colusa Co. It is probable that gold will be found at most, if not all, of the quicksilver localities. Some, at least, of the cinnabar veins are in formations as recent as the Miocene Tertiary. Both Mr. Atwood and Prof. Silliman collected Miocene fossils from the quicksilver-bearing rocks of San Luis Obispo.‡

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* Notes on the Geographical Distribution and Geology of the Precious Metals, etc. Transactions of the California State Agricultural Society, for the years 1864 and 1865. p. 361.

† From Mr. Goldsworthy, of Colusa.

San Francisco, Cal., May 9, 1866.

Dr. Jackson exhibited various specimens presented by Mr. H. H. Rönne; a vegetable tallow from Bengal, called "kackum oil," used by the natives medicinally for colds, and also for cooking, giving a sour taste — the source of it is unknown; an indelible ink nut, containing between the shell and seed a coloring fluid matter of very insoluble and indestructible character; a solution from this nut in Benzole gives a brown dye, changing to black; it seems also to possess poisonous properties; mucilaginous Chumalla seeds used in glazing India silks, and also for medicinal purposes in affections of the eye; Ghantee root much like Munjeet, yielding a yellow instead of a red dye, and also Cashew nuts, the kernel of which is used as an article of food, and also as an ingredient in chocolate. They are imported into Bombay chiefly from Goa; the kernel is extracted by placing the nut in the fire.

Mr. F. W. Putnam read an extract of a letter from the Rev. A. B. Kendig of Davenport, Iowa, concerning an ice cave in Decorah in that State, in which the ice forms in summer and disappears in winter.

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* Similar pebbles are mentioned by Prof. Whitney in his Report. I. p. 92.

† Trans. Cal. State Ag. Soc. 1864 and 1865. p. 173. Report of Prof. R. Oxland.

‡ Noticed by Mr. Gabb, Proc. Acad. Nat. Sci. Cal. III, (2), 173.

Dr. C. T. Jackson said that similar phenomena had been noticed in Russia, and alluded also to the well in Brandon, Vt., which exhibited the same peculiarities.

Dr. Jackson also spoke of the occurrence of veins of Dolomite in the Emery mine at Chester, in this State, which contained a crystalized sapphire.

Mr. S. H. Scudder was elected Custodian.

October 17, 1866.

The President in the chair. Thirty-three members present.

The following papers were read:—

VIEW OF THE LEPIDOPTEROUS FAUNA OF LABRADOR. BY A. S. PACKARD, JR., M.D.

This preliminary view of the Lepidopterous insects of Labrador is the result of the explorations of two summers. It will be seen that many of the most common forms are circumpolar species, common in high latitudes, showing that as regards the insect fauna, the assemblage found immediately upon the coast is almost purely arctic in its character, agreeing closely with the Greenland fauna, and more remotely allied to that of the Scandinavian mountains, especially the fjelds of Norway and Finmark. In the interior of the country, where it is warmer and more thickly wooded, we should look for an assemblage similar to that developed by Dr. Barnston on the shores of Hudson's Bay, which consists of a large intermixture of boreal forms. Such incursions of boreal or "Canadian" species begin to be felt at Caribou Island in the Straits of Belle Isle in southern Labrador.

I am indebted to Mr. S. H. Scudder for a list of the butterflies, and to Mr. B. P. Mann for the loan of a few specimens collected by him in 1864, while a member of the same party as myself.

Argynnis Boisduvalii Sommer. Caribou Island, Straits of Belle Isle. From Square Island northward. July 14–August 3. Abundant.

Argynnis Triclaris Hübner. Caribou Island; and from Square Island northward. July 14–August 3. Abundant.

Argynnis polaris Boisduval. From Square Island northward. July 14–August 3. Abundant.

Argynnis Frigga Thunberg. Okak, Rev. S. Weiz, one specimen.

Grapta interrogationis Doubleday. Okak, Rev. S. Weiz; first time recorded from Labrador.

Chionobas Jutta Hübner. Hopedale, August 3. Square Island, July 14. 2 ♂. The species of this genus appear about the first of July.

Chionobas Bore Esper. Hopedale, August 3. Four specimens.

Chionobas Oeno Boisduval. Hopedale, August 3. Strawberry Harbor; abundant. Mr. Scudder does not consider *C. Also* Boisd. to be distinct from this species.

Lycæna Aquilo Boisduval. Hopedale, August 3. Henley Harbor, August 15. Very abundant. Sloop Harbor. It was first observed at Sloop Harbor, in Kyuetarbuck Bay, July 19.

Pieris frigida Scudder. Caribou Island, Straits of Belle Isle. Not infrequent. July 14–30.

Colias labradorensis Scudder. Caribou Island. Frequent in July; first observed July 14. Hopedale, August 3.

Colias Palæno Linné. Strawberry Harbor, July 26. Frequent.

Colias Nastes Boisduval. Strawberry Harbor, July 26. Hopedale, August 3. Frequent.

Hesperia Comma Linné. Okak, Rev. S. Weiz.

Hesperia Centaureæ Boisduval. Okak; Weiz.

BOMBYCIDÆ.

Euprepia caja Christoph, Entom. Zeitung, Stettin, XIX. p. 312. 1858.

Whatever may be determined as to the specific distinction of *E. americana* as found in Canada and New England, the form which we meet with in Labrador has every appearance of being an introduced species. It occurred in the larva state at Gore Island, near the Little Mecatina Island, in southern Labrador, where the caterpillars were full fed, and wandering over the herbage. This specimen is much smaller than a specimen before me from England, but the coloration and markings are the same, and it can scarcely lay claim to be considered as a climatal variety. At Caribou Island the larvæ were found in July in various stages, feeding on the *Potentilla anserina*, near the sea. A specimen from Okak varies from the Gore Island specimen in having less whitish marks, as they are inclined to be obsolete. The patagia are white in the Labrador specimens, and brown in the English specimens; this is the principal distinction.

The larva was found full fed, crawling over herbage on June 15th, at Little Mecatina Island, and it had no doubt hybernated in this state.

The body was black, with large white papillæ, from which on the thoracic rings rise short yellow hairs like those on the sides of the body. Above, the white papillæ are large and conspicuous, and from them arise long, thin, mostly irregular fascicles of pale gray hairs, with shorter and fewer black hairs, the longer ones equalling in length the breadth of the body.

It is of the usual size, and its tri-colored hairs and white papillæ give a striking appearance to this handsome larva.

It began to spin a cocoon June 26, and the moth appeared July 27.

Platarctia borealis Packard, Proc. Ent. Soc. Phil., III. p. 111. 1864.

Arctia borealis Möschler, Wien. Entom. Monatsch. IV. p. 360. Taf. 9. fig. 3. 1860.

Okak, Rev. S. Weiz.

Arctia Quenselii Paykull, Hübner. Christoph, Ent. Zeitung, Stettin, XIX. p. 312. 1858.

Arctia speciosa Möschler, Wiener Ent. Monatsch. viii, 1864. p. 195. Taf. 5. fig. 13 ♂, 14 ♀.

Nemeophila (Chionophila) *Quenselii* Guénée, Ann. Soc. Ent. France. 4ᵉ Trim. 1864.

It is very desirable to have specimens from the Alps and arctic regions of Europe, before deciding on the identity of so variable a species as the present. However entomologists may differ as to the specific character of this form, there can be no doubt that with *A. Dione* and *A. virguncula* of Kirby, it forms but a section of the genus Arctia as restricted by us in the Synopsis of the Bombycidæ of the United States. (Proceedings of the Entomological Society of Philadelphia, Vol. III, p. 115, 1864).

Guénée, in the work cited above, refers the *Arctia cervini*, which is very closely allied to *A. Quenselii*, to the genus *Nemeophila* of Stephens, and then goes so far in the subdivision of this "genus" (Nemeophila) as to eliminate from it the genus *Chionophila*, in which he includes *Chionophila plantaginis* (Linn.), *C. Quenselii* (Paykull), *C. glaphyra* (Eversm.), and *C. virguncula* (Kirby).

We have two males from Okak, together with two females from the alpine summits of the White Mountains of New Hampshire. One of the latter was reared from the pupa by the late Mr. C. A. Shurtleff, and taken on Mount Washington, while the other was reared by myself from a larva found by Mr. Scudder on the summit of Mount Madison. None of the specimens are alike, all presenting marked variations. The ♂ specimens from Okak are much smaller than those (♀) from the White Mountains, the abdomen is blacker, and the yellowish white lines are not visible from above on the abdomen; but these seem to be but sexual differences. In one of the Okak specimens the hind wings are entirely black, with the darker diffuse discal spot unusually distinct; but another much rubbed specimen presents indications of being streaked on the hind wings like one of the White Mountain (♀) specimens. The two specimens from Okak differ as much from one another as the two White Mountain moths; the two outer subcostal square patches in one being united, and in the other, separated. One of the White Mountain moths differs from all the others of both sexes, in having a transverse yellow band crossing the inner third of the wing, thus breaking the surface up into black spots, which seems to be an unusual variation. The front of the head, also, is entirely black, where in all the others it is yellowish with a central black spot varying in size.

Both ♂♂ differ much from Möschler's figure of *A. Quenselii*, var. *speciosa*, in that the body is entirely black above, and the fore wings have broader yellow bands and the hind wings are entirely black.

Arctia ——— ?

A singular larva was found on the Larch, at Square Island, July 8th. It is remarkably short, thick, broad, and a little flattened; and so densely covered with short, evenly cut, very broadly spinulated hairs that the segments of the body can not be distinguished; the dorsal hairs are shortest and thickest, those on the sides are longer and more uneven. Seen from above, both ends of the body are concealed by over-arching hairs, causing both extremities to look alike. The head is black, body beneath black; false legs livid; hairs dark umber-brown, appearing as if dusted over, owing to the remarkably long pectinations or spinules of the hairs. On each side is a subdorsal, obscure, rather broad band of yellow on the first eight abdominal rings, not appearing on the thorax. Length one inch; breadth one-third of an inch.

Orgyia Rossii Curtis. Möschler, Wien. Ent. Monatsch. IV, p. 360. Nov. 1860. "Labrador," Möschler.

NOCTUIDÆ.

Leucania rufostrigata *n. sp.*

♂. Of a pale whitish luteous gray. Head and body alike concolorous. Fore wings with the costal nervure streaked with whitish scales, as is the median nervure and its branches. The middle of the wing (longitudinally) is shaded with rusty brown between the nervules; a marginal row of rusty streaks is situated between the nervules. Fringe concolorous with the rest of the wing. Hind wings paler, with no markings, and only a marginal row of brown inter-nervular lines; fringe paler. Beneath, a shade darker than above on the costa; below the submedian whitish; nervules darker. Hind wings with no discal dot on the fore wings; growing paler inwards. Legs not ringed, concolorous with the body.

Length .57; fore wing .57 inch.

This species is short and stout, with unusually short, broad wings; the antennæ have long ciliæ; while the middle of the fore wings is covered with slightly reddish brown scales, but the costal nervures are paler, and there is a marginal row of reddish-brown streaks ending in lunules.

Rising at twilight out of the tall beach-grass on Caribou Island, Straits of Belle Isle, July. Frequent, flying July 24 around the Beach Pea.

Agrotis littoralis *n. sp.*

♂. Of a uniform glossy pale luteous tawny-brown; antennæ well pectinated. Palpi very large and stout, with long ciliæ beneath; the third joint long, porrect, cylindrical, acute, end of second joint sloping continuously with the front, which is concolorous with the thorax and abdomen, being of a pale tawny-brown. Fore wings smooth, on the basal third of the wing an oblique irregularly 4-dentate line, the teeth situate between the nervules, pointing outwards between the median, submedian and internal nervures, but directed inwards on the median space, then curving outwards on the costa nearly to the middle of the inner discal circle, which is large, and formed by a simple brown unshaded ring; the outer reniform spot is large, and shaded on the inner half, especially on the lower end at the origin of the mesial nervules. Beyond is a simple line, broadly curved opposite the reniform dot, going from the outer third of the costa around to the inner third of the hind margin. Beyond is a parallel line of dark streaks of uniform length and width, situated either upon, or between the nervules. Beyond is a submarginal line diffusely shaded inwards, and forming a diffuse triangular dusky spot on the costa, below which is an angular sinus; on the submedian fold it is bent inwards; a marginal dark line, scarcely interrupted by the nervules. Fringe long, concolorous with the rest of the wing. Hind wings a little more dusky than the anterior pair, pale on the costa; edge dark; fringe pale tawny, concolorous with the costa. Legs darker than the body. Beneath dusky, with a diffuse dusky discal spot, and two parallel dusky lines; beyond, a broad, paler margin. On the hind wings is a lunate discal dot, and an outer diffuse, obscure, shaded patch on the costa.

Length of body .62; fore wing .60 inch.

Differs in its wings being of an uniform tawny color, with a plain ringlet, and large reniform dot, with the rows of dots beyond; by the submarginal diffuse line, and well pectinated antennæ.

Caribou Island, found in abundance with *Leucania rufostrigata* rising, when disturbed, from the beach grass. July 24.

Agrotis umbratus *n. sp.*

♂. Of a peculiar uniform ashen umber-brown, with a slight olivaceous hue. Head and thorax concolorous with the fore wings, head a shade darker. Antennæ concolorous, well ciliated as usual. Fore wings uniformly ashen-umber, with an indistinct black line on the inner third, which is straight on the costa, but angular just below the median nervure, and there is a very acute long angle on the inner edge. A lunate discal black dot, shaded diffusely within with black; an outer curved, very acutely zigzag black line, the teeth very long, acute and narrow, curving around, and ending on the costa; above and opposite to the discal dot, the line is very slender and consists simply of dots and points, rather than a continuous line. A slight, obscure, submarginal line. Fringe scarcely lighter than the wing. Hind wings pale, nearly concolorous with the abdomen, without lines, discal dot also obsolete. Legs ringed with paler bands.

Beneath uniform cinereous, with a dusky outer diffuse line, which is much curved; on the hind wings obsolete on the inner margin. No discal dot on the fore wings, very obscurely marked on the hind wings.

Length of the body .65; fore wings .70 inch.

This fine species is characterized by the want of definite markings. There is no discal dot on the hind wings above, or on the fore wings below. It may be known by the very acutely zigzag line consisting of very acute points, with dots between, and no other markings except the inner line and the diffusely shaded discal dot.

Okak, Rev. S. Weiz.

Agrotis Okakensis *n. sp.*

♀. Cinereous, with an obscure lilac tinge. Head and palpi sable-brown, as is also the prothorax. Antennæ pale, whitish above, minutely ciliated. Thorax concolorous with the fore wings, while the abdomen is concolorous with the hind wings. Fore wings pale ashen, with a slight lilac tinge, especially on the costal and outer and inner edges, the middle of the wing being reddish-brown, which tint runs into the costa near the apex, where are also three minute oblique parallel whitish streaks. An oblique brown line, partially obsolete at the base, goes from the costa inwards. The inner discal dot is a large triangular, very conspicuous pale spot, darker within, and becoming obsolete on the costa, as if truncate. An oblique whitish stripe on the submedian, just below the inner triangular spot. The reniform dot is close to the inner discal dot, the lower lobe is much the larger, and the edge whitish, within lilac-cinereous; between the two spots the wing is clear brown. An outer obscure brown line forms a great S, curving inwards regularly from near the inner angle, then sweeping by a great curve outwards, opposite the discal spot, being once acutely, finely toothed just below the costa, and thence going obliquely by a straight course back on to the outer fourth of the costa. A little beyond is a similar, more obscure submarginal line, beyond which the margin is lilac-gray; a marginal row of brown linear spots, fringe ashen-brown. Hind wings with no line, discal spot obscure and diffuse.

Beneath, the same as the hind wings above, with no cross-lines, while the discal dot on both wings is diffuse, but distinct. Costa a little more dusky, edge of fore wings slightly pale cinereous, concolorous with the costa of the hind wings. Legs brownish.

Length of the body .65; fore wing .60 inch.

This species is smaller than *Agrotis Wockei* Möschler, differing in having no common line on the under side; in having no dark streaks wanting the subapical dark spots. The reniform dot in *A. Okakensis* is larger beneath, while the inner discal dot is much larger and distinctly triangular. Otherwise it is more closely related to *A. Wockei* than any other species.

Okak, Rev. S. Weiz.

Agrotis dissona Möschler, l. c. p. 365. Taf. 9, fig. 5. 1860.

"*Agrotis rara* Herrich-Schaffer, Bd. VI. p. 59. Suppl. fig. 554."

"Labrador," Möschler. p. 367.

Agrotis comparata Möschler, l. c. VIII. p. 196. 1864.
"Labrador," Möschler.

Agrotis speciosa Hübner. Möschler, l. c. 196. 1864.
"Labrador," Möschler.

Agrotis Wockei Möschler, l. c. 196. 1864.
"Labrador," Möschler.

Agrotis fusca Boisduval. Möschler, l. c. 197. 1864.
"Labrador," Möschler.

Agrotis septentrionalis Möschler, l. c. 197. 1864.
"Labrador," Möschler.

Dianthœcia phoca Möschler, l. c. 197. Taf. 5. fig. 15. 1864.
"Labrador," Möschler.

Dianthœcia subdita Möschler, l. c. 363. Taf. 9, fig. 7. 1860.
"Labrador," Möschler.

Pachnobia carnea Thunberg. Hübner, 435. *Ampla.* 377. *Tecta.* Möschler, l. c. 198. 1864. Herrich-Schæffer, Suppl. 401. Bd. II. p. 198.
"Labrador," Möschler.

Hadena exornata Möschler, l. c. 1860. Taf. 9, fig. 5. p. 364.
"Labrador," Möschler.

Mamestra arctica Boisduval.
One specimen, Straits of Belle Isle, (Hopkins).

Episema? gothica Christoph, l. c. p. 312. 1858.
"Labrador," Christ.

Anarta (Crymodes) exulis Lef. Möschl., l. c. 1860. p. 364.
"*H. gelata* Lef. *H. grœnlandica* Dup. *H. fovea* Dup. *Neuria cervina* H.-Schæffer. *Exarnis difflua* Hübn. Geyer. *Noctua arctica* Thunbg. *Crymodes gelida* Guén. *C. poli* Guén. *Hedena marmorata* Zettdt." Möschler.

Anarta Richardsoni.
Hadena Richardsoni Curtis, App. Ross' Voyage. Pl. A, fig. 11.
This species is a true Anarta, though the palpi are not so stout as usual in the genus.
Okak, Rev. S. Weiz.

Anarta gelata ?

? *Hadena gelata* Lefebvre, Ann. Ent. Soc. France, vol. 5. p. 393. Pl. x, fig. 3. 1836.

So closely allied to Lefebvre's *gelata*, that I do not at present dare to separate it, as my specimen is somewhat rubbed. It differs in its roseate head and prothorax, and the submedian linear light spot is much nearer the larger median one than in the figure of Lefebvre.

The wings beneath are of a uniform cinereous, with a luteous tinge. and are slightly reddish towards the costa. The palpi are darker and more concolorous with the head than Lefebvre's description would indicate.

Okak, Weiz.

Anarta nigro-lunata *n. sp.*

♂. Of the usual dusky cinereous color, with black and white scales. Abdomen darker than usual. Palpi stout, ascending, passing as usual beyond the front, beneath paler. Fore wings with a black costal spot at base, and beyond an oblique black line directed inwards to the median nervure. An inner round discal black spot, with one beneath, and a third narrower one on the inner margin. The reniform dot is very large, black, distinct, dilating on the lower lobe; beyond is a sinuate line of black dots; a sub-marginal diffuse sinuate zigzag line within, extending on the costa to the line of black dots; margin clear gray, fringe dusky, interrupted with narrow white streaks. Hind wings black, with the middle white; the black base reaches to, and partially includes the large, broad, discal, regular, lunate spot, and broadly lines the inner edge, and also the margin. Fringe white.

Beneath whitish, with the reniform dot present on the fore wings, and the discal dot on the hind wings large black, appearing distinct on the white wings. Dusky towards the base, the black extending also on to the costa and inner margin. A rather broad, dusky, submarginal line on the fore wings, which is doubled on the costa. A marginal row of internervular black lines. Fringe dusky, with white streaks. Hind wings with a broad blackish margin; fringe white.

Length of body .45; fore wing .46 inch.

Okak, Rev. S. Weiz.

At once known from all the other species by the two large, black, discal spots, the outer being larger and reniform; and also by the large lunate discal spot on the hind wings, which together with the reniform dot, is very conspicuous on the white underside. Beyond the reniform spot, the row of black dots, and the clear grey edge of the wings will farther distinguish it from any other Anarta, though, in many respects it approaches *A. Richardsoni.*

Anarta leucocycla Staudinger, Ent. Zeitung, Stettin, 18. p. 296. 1857.

Sympistis leucocycla Möschler, Wiener Ent. Monatsch. IV. p. 367. Taf. 9. fig. 6. 1860.

Labrador, Möschler; Greenland, Staud. Okak, S. Weiz.

Anarta bicycla *n. sp.*

♂. Closely resembling *A. leucocycla*, but differs in having an inner and outer white discal circle, instead of a single one. Head very hairy, palpi ascending, reaching far beyond the front, being large and stout, with white and grey scales. Prothoracic scales whitish at base. Fore wings dark stone grey, with whitish scales; at the base an oblique sinuate black line goes from the costa to the median nervure. Beyond is a costal, square, oblong, black spot, connecting with four black spots, crossing the wing in a zigzag interrupted line, the second spot forming the outer side of the discal black line enclosing two unequal round white spots, centred with black, the inner one being a little elongated, and the outer round. Halfway between them and the inner edge, is a distinct regular black stripe, obliquely following the general course of the lower median nervule, and touching externally on an extra discal, sinuate, irregular whitish line, which before reaching the costa, strikes inward at a right angle, terminating in a white costal spot opposite the outer discal spot. Beyond is a submarginal sinuate black line, edged with pale gray. Fringe dark, with wedge-shaped white spots in the middle of the wing. Hind wings dusky at the base, nearly including the curvilinear discal dot; beyond white, except on the costa. Edge broadly margined with deep black, fringe white, dusky at base towards the apex of the wing. Beneath, the body is pale gray; fore wings dusky gray, with a minute discal black point opposite a dark costal stripe, edged without with white, which is angulated inwards towards the middle of the wing; outer edge margined broadly with black; fringe dusky, spotted with white. Hind wings towards the base more white than above. Abdomen gray. Legs dark, ringed with white.

Length of body .45; fore wing .45 inch.

♀. The wings are more oblong, and the outer edge straighter, and apex less produced than in the male. The costal spots are not so large; the wing is crossed by three distinct ziczac black lines which are more connected than in the ♂; the submarginal line is narrower, composed of cuneiform black marks. Beneath, the subapical, black, oblique stripe is broader than in the ♂.

Length .40; fore wing .44 inch.

This is not an uncommon species, and more of them were found than of *A. algida* or *A. amissa*. It closely resembles *A. leucocycla*, but the hind wings are white, and the discal dot very much smaller. There are two white circles on the fore wings instead of one. The species can also be easily distinguished by the distinct black oblique submedian stripe, connecting with the outer extradiscal zigzag gray line; and also on the broad black margin, especially on the fore wings. From *A. algida*, it differs by the same characters, and also its much smaller size; and the outer row of cuneiform black spots is situated farther from the edge of the wing, and is much more sinuate.

Whole Atlantic coast of Labrador, July.

Anarta amissa Lef. l. c. p. 397. Pl. x, figs. 6 and 7. 1836. Möschler, l. c. 1860. p. 367.

Okak, Weiz. It also occurs at Greenland and Lapland.

Anarta algida Lef. l. c. p. 395. Pl. x, fig. 5. 1836. Möschler, l. c. 1860. p. 367. Christoph, l. c. 1858. p. 312. "End of June, July." Christoph, Ent. Zeitung. Ent. Ver. Stettin, XIX. 1858.

Indian Harbor, Aug. Taken while resting on the herbage of this exposed locality. It also occurs in Lapland.

Anarta cordigera (Thunberg). Christoph, l. c. 1858. p. 312. Möschler, l. c. 1860. p. 367.

"Labrador," Christoph, and Möschler.

Anarta vidua Christoph, l. c. 1858. p. 312.

"Labrador," Christoph, and Möschler.

Anarta melaleuca (Thunberg). Christoph, l. c. 1858. p. 312. *Sympistis melaleuca*, Möschler, l. c. 1860. p. 370.

"Labrador," Christoph, and Möschler.

Anarta melanopa (Thunberg). Möschler, l. c. 1860. p. 367.

Anarta funesta (Thunberg).

Sympistis funesta Möschler. ("*funebris* Hübner"). l. c. 1860. p. 370.

Plusia divergens Fabr. Möschler, l. c. 1860. p. 370.

"Labrador," Möschler.

Plusia parilis Hübner. Möschler, l. c. 1860. p. 371.

"Labrador," Möschler.

Plusia U-aureum Boisd. Möschler, l. c. 1860. p. 371.

"*P. interrogationis* var? *P. grœnlandica* Staud." Möschler.

"Labrador," Möschler.

Brephos parthenias (Linn.). Möschler, l. c. p. 371.

"Labrador," Möschler.

PHALÆNIDÆ.

Acidalia okakaria *n. sp.*

Very uniform, finely mottled gray, with a pearly lustre on both wings. Head with the vertex whitish; antennæ finely ciliated, gray above, with blackish fine scales. Front black, orbits with a few gray scales. Palpi black, with a few gray scales above. Wings with three dusky obscure stripes; the basal line oblique, not zigzag, obsolete on the costa and inner edge; a mesial oblique line; the outer parallel line once waved and flexed outwards in the middle of the wing. No discal dot, or any other markings on either wings. Edge with a very narrow dark line. Fringe long, concolorous with the rest of the wing. Hind wings with two lines, the inner very obscure, the outer more distinct, curved and sinuate slightly in the middle. Edge of the wing and fringe just as in the fore wing.

Beneath, very uniform gray, but little lighter than above, at the base of the wing a pearly lustre; darker on the costa and outer edge, with the lines as distinct as above, the outer more so, and flexed as above. No discal dot on the fore wing; that on the hind wings is nearly obsolete. Legs dark above, paler beneath.

Length of the body .38; fore wing .48 inch.

Okak, Weiz. Hopedale, August 3. Frequent.

This species is closely allied to, but differs from Möschler's *A. frigidaria* in having no discal dots except on the hind wings, and these are only apparent on careful examination. The lines are not waved, except at the slight flexure of the outer line. The antennæ are not white above, as they are said to be in Möschler's species, and the fringe is darker than his description of that of *frigidaria* would indicate, while the outer line is not pointed beneath on the nervules as in the other species.

Acidalia frigidaria Möschler, l. c. 1860. p. 373. Taf. 10. fig. 1.
"Labrador—Moravian missions," Möschler.

Acidalia spuraria Möschler, l. c. 1860. Taf. 10, figs. 6, 7. p. 372.
Aspilates spuraria Christoph, l. c. 1858. p. 312.
"Labrador," Christoph, and Möschler.
Okak, Weiz.

Aspilates gilvaria S. V. Möschler, l. c. 1864. p. 198.
"Labrador," Möschler.

Anaitis sororaria Hübn. Christoph, l. c. 1858. p. 313. Möschler, l. c. 1860. p. 373.
"Labrador," Christoph, and Möschler.

Macaria sex-maculata *n. sp.*

♂, ♀. Head pale gray, dusted with blackish scales. Palpi stout, bushy, with darker scales, extending well beyond the front. Thorax and body concolorous with the wings. Fore wings of a uniform stone gray, with brown scales, and six large conspicuous dark-brown patches, four on the costa, and two geminate ones on the middle of the outer third of the wing; the inner costal spot is nearly obsolete; the third one connects with an indistinct line, and goes straight to the inner edge, including the inner edge of the second square mesial spot, becoming obsolete toward the inner angle. Margin narrowly edged with brown; fringe dark gray, with darker nervular streaks, which become obsolete towards the inner edge. Hind wings paler, with a slight luteous tinge, a slight discal dot, and two obscure diffuse outer brownish lines. Fringe long, interrupted by dark spots.

Beneath, the costa and nervules are ochreous, with dusky mottled flecks; edge of the wings paler; just before the edge a broad dusky band, most distinct just below the costa, bounded within by a distinct dark line. Hind wings with a rather broad, diffuse, submarginal band. Edge of the wings flecked with white.

Length of the body .35; fore wing .45 inch.

This species differs from any more southern form by its smaller size, its dull, obscure, stone gray color; the two square, mesial, twin spots, the two outer obscure lines, and the double line on the hind wings. Also by the want of any discal dot on the fore wings, and the absence of the intradiscal lines.

Square Island, Labrador, July 14. Occasionally seen.

Scotosia dubitata var.

♀. Specimens of this species, which were collected in Hudson's Bay Territory by Barnston, and also in Canada, were referred by Mr. Walker in the Catalogue of the Lepidoptera in the British Museum, to a variety of the common European *dubitata.*

Our Labrador species agrees well with a specimen from the Fish River Lakes in Northern Maine, and they seem to present indications of a climatal variety of the European form. We have compared a Labrador and a Maine specimen with a single English specimen.

It is a large, pale cinereous species, with a reddish tinge. The fore wings are crossed by three reddish zigzag bands; the basal one being curved angularly on the costa. Beyond are three very zigzag lines, interrupted by two paler bands; the middle reddish band is less curved than the basal one, accompanied on the inner side by a dusky band; this line contracts slightly opposite the small, dark, narrow, oblique, discal spot, which is nearer the line than in the European specimen. This line also contracts on the inner edge. The outer line is irregularly scalloped, but is straight on the costa, with a subacute curved angle on the lower subcostal nervule, below which is a broad, regular sinus, rounded out, terminating in the middle of the first median space, but not nearly upon, or just below the first median nervure, as in the English specimen. Below, the line is regularly scalloped between the nervules. Beyond, the submarginal line is much more dusky than in the English moth, with two faint rows of white strigæ on the nervules, with a distinct white submarginal line, and a black, linear, scalloped line; fringe dusky.

The hind wings are crossed by two distinct, but rather diffuse dusky submarginal lines, which are more distinct beneath, and do not appear in the English specimen. Beneath, it is more dusky than in the specimen from England, with the outer line on the fore wing differing from the European moth as described above.

Length .55; fore wing .80 inch.

Caribou Island, Straits of Belle Isle.

Larentia polata Boisd. "Phæsyle polaria Boisd." Christoph, l. c. 1858. p. 313.

Seventy-five specimens were captured in a single day on a naked, almost bare rock at Table Island in Henley Harbor, which is much exposed to the open sea. They were in great abundance, settling down with their peculiar vacillating flight, like feathers on the ground.

There was considerable variation among them; some were more dusky than others, with a greater profusion of golden scales; in others the central dark band of ringlets became reduced to mere points on the inner edge, with the region on each side very pale, and almost entirely free from yellow scales; or the entire line may consist of points alone, accompanied by a broad, dusky, submarginal band. Others have no yellow scales at all, and the mesial band is diaphanous, leaving the discal dot very distinct, while all the characteristic bands and rows of dots are brought out in very clear relief, as in Lefebvre's var. *Brullei.* The size of the dusky spots on the fringe varies greatly.

Hopedale, Indian Harbor, Henley Harbor and Caribou Island, August. It is a truly arctic species, being found in Greenland and Lapland, and the colder exposed portions of the Labrador coast. Were it not for the broadly pectinated antennæ represented in Curtis's figure 12, Pl. A. of Ross's Voyage, Appendix, I should refer this (*Psycophora Sabinii* Curt.) to *L. polata.*

Larentia gelata Guénée, Lep. Pl. 14, fig. 6, may prove to be a variety of *L. polata.*

Dr. Staudinger says that the genuine *L. polata* is found in Lapland, while the Labrador form is the var. *Brullei.*

Eupithecia luteata *n. sp.*

More luteous on the fore wings than usual. Palpi rather stout, hairs scarcely as long as usual; front dark cinereous; thorax and abdomen dark cinereous. Fore wings cinereous, with darker scales, especially on the costa, and towards the apex, the base of the wing is crossed by dark diffuse lines; discal dot larger, more diffuse than usual; beyond is a broad luteous band, very diffuse and irregular, but free from dark scales, and still beyond is a submarginal diffuse blackish band; fringe as usual. Secondaries with a dusky discal spot; edge of ring black; fringe long, cinereous, interrupted by narrow dusky spots; inner margin of the wing with blackish scales, gathered just beyond the discal dot into a faint diffuse line, disappearing towards the middle of the wing.

Length .35; fore wing .42 inch.

Caribou Island, Straits of Belle Isle, July 14, 1860.

This species is much larger than several allied forms from Maine, and the discal dot is more diffuse and larger, the space beyond luteous, more clear from dark scales, while the anterior two-thirds of the hind wings are clearer.

Beneath, the discal dot is distinct, on the fore wings being black, linear; with an outer slightly sinuate line; a little dusky on the costa and outer edge. On the hind wings a dusky line, more distinct than above. Legs pale, as usual.

Eupithecia gelidata Möschler, l. c. 1860. p. 376.
"Labrador," Möschler.

Melanippe gothicata Guénée. *Cidaria hastata*, var. *gothicata* Guén. Möschler, l. c. 1860. p. 373. Taf. 10, figs. 4 and 5.

Two varieties occurred in abundance at Caribou Island in July. One of the forms is common in Maine, the other was one half white; the black spots are partially obsolete, and this variety has never been detected south of Labrador, so far as I know; but I should agree with Dr. Staudinger in considering it a simple variation.

Coremia labradorensis *n. sp.*

♂. Allied to *C. propugnata*, but the antennæ are much more finely ciliated. Palpi as usual. Body dark cinereous with black scales, and some of a slightly reddish tinge. Abdomen with a pair of oblique diverging black streaks on each ring. Base of the wing brown; beyond, a broad cinereous band; a broad, brown mesial patch; the inner side regularly curved outwards, not zigzag, but with the edge entire, with a broad, black line; in the middle of the band two dark, slightly oblique sinuate lines; the outer side of the band is very irregular, consisting of two large, unequal, subacute teeth, the lower larger and double; below, the band contracts, being bidentate on the outer edge, which is black. Beyond is a row of nervular dots; the usual submarginal whitish zigzag line, with the edge black between the nervules; fringe dusky. Hind wings with indistinct dusky zigzag lines.

Beneath, the outer side of the mesial line is partially reproduced, especially on the costa. Discal dot distinct, especially on the hind wings, which are crossed by two outer black irregular lines.

Length of the body .40; fore wing .55 inch.

This species is a transitional form to *Cidaria;* its essential characters closely allying it to *Cidaria*, while the style of coloration is that of *Coremia*, though we should scarcely feel justified in uniting the two genera.

It differs greatly from *C. propugnata*, in the dull brown middle portion of the middle band; and in its very irregular and quite different outer edge, with its mottled and strigated outer border. Like that species, however, it wants the geminate dark spots on the outer margin of the fore wings.

Caribou Island, Labrador.

Cidaria russata W. Verz.

Specimens not differing from those inhabiting New England, especially Maine and the White Mountains, occurred not unfrequently at Caribou Island, August 19.

Cidaria brunneata *n. sp.*

This fine species in its long, slender, acute wings, with the outer margin unusually oblique, and in its style of marking, is related to *C. russata*, though very much smaller. It may be readily recognized by the two broad brown bands, which are irregular on the edges.

♂. Antennæ filiform, long and slender, minutely ciliated beneath, basal joint white. Palpi short and small, rather hairy, a little upcurved, scarcely passing beyond the front, which is cinereous, with dark scales.

Thorax cinereous, with dark scales, abdomen paler cinereous. Wings quite uniformly dark ashen; a sub-basal irregular brown band, whitish on the costa, and edged with whitish below; a broad, mesial, dark cinereous band, three times as broad on the costa as on the inner edge, with each side irregular dentate; on the inner side a large tooth near the inner edge of the wing; on the outer edge, a large tooth situated on the first median nervure. Beyond, is a broad brown band, similar to the inner one, narrowed in the middle by the large tooth of the mesial band, margined with a paler line of acute spots, and becoming black on the costa; a minute oblique pale apical streak; black spots on the margin as usual; fringe dusky; no discal dot; on the pale hind wings a discal spot with two outer submarginal curved lines.

Beneath, paler, subluteous on the outer third of the fore wings, like the entire surface of the secondaries, which have a submedian dusky patch, most distinct on the costa; fringe pale, interrupted with dusky. Legs dark, banded conspicuously with white.

Length .35; fore wing .45 inch.

It may be known by its inner and outer broad brown bands, margined externally with whitish, the inner band becoming whitish, the outer blackish, on the costa.

Caribou Island, mouth of Esquimaux River, August 3.

Cidaria destinata Möschler, Wien. Entom. Monatsch. p. 375. Taf. 10, fig. 2. Dec., 1860.

This species is easily known by the broad, dusky, scalloped, obscurely bidentate mesial band, with a deep sinus on the outer side, on the median vein; and by the submarginal row of acutely triangular black spots, and the blackish apical patch.

Hopedale, August 3, 1864. A single specimen.

Cidaria nubilata *n. sp.*

♂. Uniformly dark cinereous, with darker and whitish scales. Head dusky, with whitish orbits, and base of antennæ white; palpi long and slender, porrect, whitish above and at the extreme tip, dark beneath; ends of tegulæ whitish; antennæ flattened, simple, ciliated beneath. Fore wings uniformly dusky cinereous, near the base two parallel white lines, straight on the costa, and on the costa the same distance apart as the three succeeding lines, below zigzag; the inner line acutely pointed inwards on the subcostal vein, thence going straight to the inner edge; second line acutely dentate outwards on the median cell. In the middle of the wing are two parallel lines, equi-distant from the other lines, white, edged within with black, which are succeeded behind by a row of obscure ringlets. The outer distinct white line crosses the wing, margined within with blackish, has a long curve outwards from the costa to the middle of the extra-discal space, with a large, broad, obtusely tridentate expansion, below which it goes straight to the inner edge, but is minutely serrate. An outer submarginal zigzag line of acute internervular triangular dots; a white apical streak, edged below with blackish. Fringe unusually dark and dusky, with still darker obscure spots on the ends of the nervules. Hind wings dusky, pale at base, with two parallel whitish zigzag lines, shaded within with dusky; edge dusky; fringe a little paler than on the fore wings, with dusky spots; no discal dots above.

Beneath, the wings are dusky, with a faint luteous tinge towards the apex; costa with four dusky marks, the third forming the beginning of the outer extra-discal line, which is broadly sinuated opposite the discal dot, is angulated outwards slightly on the median vein, and inwards again on the second or third median vein. This line, on the hind wings, is regularly curved, angulated obtusely inwards on the inner edge of the wing. Beyond, is a dusky obscure line, a dusky apical streak, and below a little dusky on the edge. Fringe paler than above, with a peculiar, somewhat luteous tinge, interrupted with dusky nervular spots. Discal dots very distinct, being linear on the fore wings, and ovate on the secondaries. Legs dusky, annulated with white, abdomen with two dorsal rows of dark spots beginning on the second segment.

Length .50; fore wings .65 inch.

This species closely resembles *C. destinata*, but differs in the dark dusky fringe, which Möschler states to be white in *C. destinata;* also in the two white lines being broadly angulated in the middle, and in having the broad lobe of the extra discal line well rounded, with the three teeth subequal, where in *C. destinata* they are very unequal. These three lines are much farther apart, especially on the inner edge, than in *C. destinata*, and the wing seems to be more uniformly dusky than in the other species, as the broad band between the basal and second line is dusky, like the rest of the wing.

It is also closely allied to Möschler's *Lygris lugubrata*, which seems to be a true *Cidaria*, but differs in the checkered fringe, in the two middle bands being united into one, and in the two whitish bands on the hind wings being more zigzag. Otherwise in the general style of markings and coloration, it approaches very closely Möschler's species.

Cidaria lugubrata.

Lygris lugubrata Möschler, Wien. Entom. Monatsch. Vol. VI. p. 136. Pl. 1, fig. 7. 1862.

Moravian Stations, Labrador.

Cidaria nigro-fasciata *n. sp.*

♂. Front full, hairy, cinereous, with black scales; palpi long and slender, porrect, extending far beyond the front; second joint bushy, broad at the tip; third joint acutely conical, depressed. Antennæ dark, stoutly ciliated, with short, stout pectinations, thorax concolorous with the front. Wings pale cinereous, with two fine, basal, black parallel lines, bent on the costa; a broad, mesial band, deep black on the edges, consisting of four bands, the outer ones heaviest, and shaded diffusely within with black, two-thirds as wide on the inner edge as on the costa; a faint discal streak; the outer line of this broad band is very black, straight on the costa; on the first median vein it has a large acute tooth, of which the lower side is nearly continuous with the course of the band. On the costa, one-half way between this band and the apex, is a square, dark spot, margined with white externally, which is the beginning of a white zigzag line, continued to the inner edge of the wing. Beyond, the edge of the wing is dusky, with a marginal row of geminate internervular fine black dots; fringe dusky at base, paler on the outer half. Hind wings with no discal dot; two outer zigzag dark lines parallel with the dusky edge of the wing, and a row of geminate black dots and fringe, as on the primaries.

Beneath, pale, with a luteous tinge; on the basal fourth of the costa is a conspicuous black spot; a mesial curved linear costal line, beyond is a sinuate black line, most distinct on the costa. Outer edge of the wing dusky, fringe as above. Discal dots distinct on both wings. An outer curved sinuate line, especially marked on the veinlets. Fringe paler than on the fore wings. Abdomen pale ashen with a dorsal row of black geminate dots.

Length .53; fore wing .43 inch.

August 2. Caribou Island, Labrador.

This species may be easily recognized by its minutely pectinated antennæ, each branch of which ends in a slight tuft of long ciliæ; by the long dark palpi, paler at tip, the broad, mesial band, both black on the outer and inner edges, and not narrowing on the inner edge so much as usual; by the broad dusky patch between this and the apex, margined externally by a white line, and by the hind wings having two distinct waved lines on the outer half, and alo by the very distinct double row of black abdominal spots.

Cidaria strigata *n. sp.*

Like the one preceding, this species has short, broad wings, not so acutely pointed as in the typical species, but the palpi are long and slender, much as usual.

♂. Antennæ with unusually large pectinations, dark, concolorous with the front and the palpi, which are long and slender, especially the third joint. Fore wings with two basal lines, a broad, black band, contracting greatly just before the hind edge, where it is about one-third as broad as on the costa; a broad, mesial tooth on the outer edge, below a little sinuated. This band is accompanied on the outer edge by a marginal dusky band, not present in *C. nigro-fasciata*. Beyond, is a row of fine, nervular, black dots; a submarginal white zigzag line, going obliquely to the apex. On the costa is a subapical pair of black stripes, the inner of the two being oblique. The hind wings are pale, with very faintly marked lines. Luteous beneath towards the apex. Two dark lines beneath, the outer one consisting of dots. Discal dots distinct, abdomen dusky, with the segments edged with white.

Length .40; fore wing .50 inch.

Differs in its broadly pectinated antennæ, the broad, mesial, black band narrowing rapidly on the inner edge. Also by the distinct discal dot, and the quite distinct dusky line along the outer margin of the band, with the distinct oblique black line on the costa near the apex, and the black dots beneath the spot on the nervules.

August 3. Caribou Island.

Cidaria aurata *n. sp.*

♂. Dull, obscure cinereous, dusted with golden scales. Front whitish, with dusky scales; base of the antennæ whitish, beyond minutely annulated with white; palpi black-brown, much darker than usual. Wings ashen, mottled thickly with dull dark scales, which are arranged in three dark, dull, obscure, diffuse broad bands, of which the outer two unite just below the median vein to form a broad patch; these lines are zigzag on the outer edges, and margined with whitish points; a parallel row of irregular golden scales, especially visible on the outer third of the wing, and also on the inner edge along its whole length. Edge of the wing dark; fringe dark at the base. Hind wings with a distinct discal dot; clear in the middle, but towards the outer edge becoming mottled with dark. Abdomen dark, ringed with whitish. Beneath, pale whitish cinereous, the lines obscurely repeated, especially marked on the costa; abdomen paler beneath. Legs pale, fore legs dark, narrowly annulated with white.

Length .52; fore wing .70 inch.

Differs in its short dark palpi, acute fore wings, which are dusted with bright golden scales on the outer third, and on the inner margin, and very faintly on the outer edge of the secondaries.

I have specimens from Okak, and Caribou Island. It also occurs not uncommonly at the White Mountains, where it was captured by Mr. C. A. Shurtleff, August 1–11, in Tuckerman's ravine, specimens of which are in the collection of this Society. Mr. F. G. Sanborn has also obtained it from Mt. Washington, New Hampshire.

There are rubbed specimens of three other species of *Cidaria* from Labrador, too much injured for description.

Cidaria disceptaria (F. R.) Christoph, l. c. 1858. p. 313.
"Labrador," Christoph. Möschler, l. c. 1860. p. 375.

Cidaria obductata Möschler, l. c. 1860. p. 374. Taf. 10. fig. 3.
"an *luctuata* var?"
"Labrador," Möschler.

Cidaria populata (Linn.) Möschler, l. c. p. 375.
"Labrador," Möschler.

Cidaria destinata Möschler, l. c. p. 375. Taf. 10, fig. 2.
"Labrador," Möschler.

Cidaria cæsiata W. Verz. Möschler, l. c. p. 376.

PYRALIDÆ.

Botys ephippialis Zettst. Möschler, l. c. Taf. 10. fig. 8, p. 377.
"Labrador," Möschler.

Botys torvalis Möschler, l. c. VIII. p. 198. Taf. 5. fig. 16.
"Labrador," Möschler.

Scopula glacialis *n. sp.*

♂. Resembles *S. prunalis* of Europe, but the palpi are a little shorter, and it is a smaller species throughout, while the apex of the fore wings is more obtuse. Of an uniform pale ashen, palpi dark on the sides, with a dark narrow line on each side and in front. Fore wings with a thrice deeply zigzag narrow black line near the base; an obsolete dark line crossing the discal space, turning outward, and becoming angulated on the submedian vein; beyond, is a paler space, on the outer edge of which is a distinct submarginal curved row of black dots, which in the middle are slightly wedge-shaped. Beyond, the wing is cinereous, with a slightly tawny tinge, as at the base of the wing. A marginal row of equilateral triangular black dots. Fringe concolorous with the wings, with a dusty line at base. Hind wings a little paler; that of the fore wings with no markings, fringe paler.

Beneath, cinereous, hind wing a little lighter than the fore wings; costa of primaries paler, with five very distinct black dots on the outer half, and the marginal row very distinct. From the middle costal dot goes a nearly straight dusky line, curving inwards, and fading away on the second median cell. A diffuse discal discoloration connects with the first costal dot. Legs pale, silvery.

Length .30; fore wing .38 inch.

Hopedale, August 3, 1864.

Pyrausta borealis *n. sp.*

♀. Dusky brown; head and palpi somewhat tawny; thorax brown, antennæ black-brown; fore wings dusky brown, with tawny yellow markings; deep tawny at basal two-thirds of the costa, which forms a curved line, turning abruptly, and terminating on the basal third of the inner edge. On the middle of the discal area, near the inner third of the wing, is a black discal spot. A broad, irregular, diffuse, submarginal, yellow band, expanding on the costa, and connecting in the middle of the wing with the marginal yellow band. There is above an obscure, discal discoloration. The edge of the wing is narrowly margined with black. Fringe dusky, concolorous on both wings, base blackish. Hind wings blackish on the basal two-thirds, especially beyond the discal dot, forming a curved band; beyond is a yellow, regular line, then a submarginal black-brown line, and a narrow linear yellow marginal line; edge narrowly black; fringe dusky. Abdomen paler, with luteous bands; body beneath pale ashen, concolorous with the legs.

Beneath, the wings are mostly yellowish, instead of dusky, as ıbove, with the dark bands much as above; the inner and outer liscal dots present.

Length .31; fore wing .32 inch.

July 14. Square Island, Labrador. Rare.

Eudorea? frigidella *n. sp.*

Wings long and narrow, costa rather convex; blackish, powdered with gray; discal dot distinct; an outer darker line margined externally with pale gray, and once sinuate in the middle. A marginal row of black dots, fringe pale. Beneath, uniformly dusky, fore wings darker, especially the costa. Legs dark, ringed with pale dots.

Length of the body .45; fore wing .50 inch.

A common species at Caribou Island, and readily distinguished by its long wings and single sinuate line, as if dislocated in the middle of the wing.

Eudorea centuriella Christoph, l. c. 314. *Eudorea borealis*, Duponchel, Lefebvre, Ann. Soc. Ent. de France, v., p. 400. 1836. Labrador, Christoph.

Eudorea? albisinuatella *n. sp.*

♂. Cinereous, with whitish scales; head ashen, with white scales on the base of the antennæ, which are very slender, whitish above and on the sides of the front. Palpi very long and slender, acute, white above, and especially beneath, dark on the sides. Thorax gray, with numerous white scales. Fore wings dusky gray, a mesial longitudinal white stripe just beneath the subcostal vein, connects with a broad regular transverse oblique white band, which is diffusely lined with whitish scales forming a transverse shade. Beyond, dusky, a submarginal white band, curved on the costa, angulated outwards on the extra-discal cell, then going obliquely and parallel with the outer edge, to the inner edge. Fringe ashen, white opposite the disc, and on the inner angle. Abdomen, hind wings and legs, all concolorous, of an uniform ashen, paler than the fore wings, with no markings; extreme edge blackish; base of fringe with a dusky, narrow line.

Beneath, very uniformly ashen, costa of fore wings with whitish scales; only the outer white sinuate line present, most distinct on the costa; edge of both wings blackish; fringe narrowly interrupted with white; legs whitish beneath.

Length .35 ; fore wing .40 inch.

Easily known by the submarginal sinuate white line, the oblique dusky band, just within the middle of the fore wing, shaded with white on each side.

Okak, Weiz.

Crambus unistriatellus *n. sp.*

Of the usual yellowish-brown color; head and palpi very pale gray, concolorous with the abdomen; palpi long, slender, acute, whitish above and within. Fore wings with a single, broad, uninterrupted, longitudinal white band, edged on each side with a few dark scales; the line extends to the outer edge, expanding upwards on the apex of the wing; edge of the costa narrowly bordered with white towards the apex; a submarginal row of black minute dots; fringe concolorous with the rest of the wing. Hind wings white above and beneath. Legs pale gray, concolorous with the abdomen and under side of the fore wings.

Length of the body .55; fore wing .50 inch.

Not uncommon at Caribou Island. It differs from any other Labrador species known to us, by the single, broad, straight, longitudinal white stripe, dilating towards the apex of the wing.

Crambus argillaceëllus *n. sp.*

♀. Of an uniform dark leaden clay color. Head and thorax with a bronzed hue, concolorous with the upper side of the palpi, which are white beneath, a white line running from them to the longitudinal white line situated just behind the subcostal vein, and dilating in the middle of the wing, ending acutely on the outer fourth; on each side of this point begin two parallel white lines, which end in a broad triangular expansion on the apex. A submarginal dark reddish-brown line starts from the costa opposite the end of the white stripe, making an obtuse angle near the apex, and then following the outer edge of the wing, terminates in a sinuate course on the internal angle. Fringe much paler, but not whitish. Hind wings dark, argillaceous above and beneath. Legs dark in front, hind legs paler.

Length of the body .35; fore wing .35 inch.

Differs from any other species I am acquainted with, in its dark leaden hue, the dark hind wings, with the single longitudinal white stripe on the fore wings, succeeded by two white parallel lines, and a broad apical patch.

Square Island, Labrador, July 14, 1864.

Crambus trichostomus Christoph, Ent. Zeitung, Stettin, XIX. p. 313. 1858. Möschler, Wien. Entom. Monatsch., IV. Taf. 10, fig. 10. p. 379. 1860.

"July and August. Frequent."

Crambus labradoriensis Christoph, l. c. p. 314.

"Okak, July."

Crambus albellus Clemens, Proc. Ent. Soc. Philad. p. 418. March, 1864.

Near the mouth of Esquimaux River, Straits of Belle Isle, August 3, 1860.

Crambus inornatellus Clemens, l. c. 418.

Caribou Island, July 15, 1860.

TORTRICIDÆ.

Sciaphila niveosana *n. sp.*

♂. White, with dusky olive scales. Head brown, with whitish scales; palpi white above, and on the sides, except on the basal joint. Antennæ brown, minutely annulated with white; thorax brown; fore wings white, mottled with dusky olivaceous scales, which form a diffuse patch on the base of the wing, not reaching to the costa; another diffuse, oblique band in the middle of the wing, which is often divided into two patches simply, not reaching to the costa; another diffuse oblique band in the middle of the wing, often also divided into two patches, not extending to the costa, or inner edge of the wing; the wing is cloudy towards the apex; fringe white; hind wings a little dusky, fringe white; abdomen dusky, with a silvery reflection, scales of tip with a tawny hue.

Length of body .27; fore wings .36 inch.

It is allied to *Sciaphila osseana* of Europe, and may be easily recognized by its chalky white wings, and dusky scales clouding the surface at the base, in the middle, and towards the apex of the wing; sometimes the wing is nearly white, with only a dusky, diffuse, discal spot. Legs brown, with a deep olive reflection.

Okak, Weiz. Hopedale, August 3. Not infrequent.

Pandemis leucophaleratana *n. sp.*

Pale cinereous. Head very hairy; palpi large and bushy. Fore wings cinereous, with reddish-brown scales; checkered minutely on the costa with white dots, alternating with very oblique brown streaks, and directed outward. Just before the falcate apex are two parallel white short lines; a large white patch on the internal angle of the wing, reaching two-thirds of the way to the costa, not extending to the outside of the fringe, and on the inside presenting a well-defined once-angulated margin. Apex much elongated, very falcate, fringe on the costa blackish, white at base; below the apex the fringe is white, interrupted by a black line just under the apex. Hind wings uniformly cinereous.

Beneath, paler, hind wings paler than the primaries, costa white, interrupted with dark linear spots, apex black-brown, with a mesial longitudinal white streak, and below suddenly white. Legs ashen; tarsi annulated with white.

Length .26; fore wings .27 inch.

Allied to *P. heparana* of Europe. It may be known by its very falcate primaries; the large white patch on the internal margin, and the two small white costal lines just before the apex.

Hopedale, Labrador, August 3. Not common.

Conchylis chalcana *n. sp.*

Front bushy, palpi long and thick, middle of front white, on each side broadly margined with yellow; palpi ochreous on the sides; antennæ dark, thorax with pale and ochreous scales, wings whitish gray, with an ochreous band and patches. Base of the wing dusky; beyond, a broad whitish band, succeeded by an oblique bronzed, ochreous band, which is dark on the costa, with dark scales in the middle of the wing. The band is deeply acutely indented on the submedian space; this is succeeded by a whitish band, with an interrupted row of deep ochreous patches, consisting of a costal and internal spot, the latter triangular, and situated on the inner edge, and margined with blackish on the edge, with a small mesial spot, with scattered deep ochreous scales. Beyond, is a dusky shade, going from the costal spot to the inner angle. Margin whitish, fringe whitish, black at base.

Hind wings dusky as usual, with a white fringe. Legs dark, ringed with whitish; hind legs pale whitish above.

Length of the body .25; fore wings .35 inch.

Strawberry Harbor, near Cape Webuc, July 26. Not common.

Differs in its deep ochreous, almost bronzed, irregular oblique band, and outer row of three spots, that on the inner edge being triangular, margined with black.

Conchylis deutschiana Zett. p. 119.
"Dovrefjeld, Norway," Wocke; Labrador, Möschler.

Tortrix gelidana Möschler, l. c. VI. p. 138. Taf. 1, figs. 9, 10. 1862. ♂, ♀. (*T. algidana* in the text.)

A common form at Hopedale, less abundant at Square Island, farther south. It may possibly be found to be synonymous with Curtis's *Argyrotosa? Parryana*, Pl. A, fig. 13.

Some specimens vary in being almost entirely bright ferruginous, with three darker triangular spots on the fore wings, arranged in a nearly equilateral triangle, the two basal ones being, one in the middle of the costa, the other at the apex. Fringe paler. Hind wings pale luteous-ashen; abdomen dark at base, tip tawny.

Hopedale, August 3 and 4. Henley Harbor, August 22.

Caribou Island, rare. This is evidently a high arctic species, growing less common southwards toward the Straits of Belle Isle.

Penthina glaciana Möschler. Wien. Entom. Monatsch. VIII. p. 199. 1864. *Sericoris glaciana* Möschler, l. c. IV. p. 380. Taf. 10 fig. 9.

Whole coast, common. At Caribou Island occurred specimens which differ in having the two white bands nearly straight, the outer especially so, having very regular sides, not sinuated deeply as usual.*

Penthina frigidana *n. sp.*

♂, ♀. Cinereous, head subfuscous, palpi cinereous. Fore wings spotted with dusky ashen and black, crossed by interrupted wavy lines, blackish on the costa; base of the wing whitish, but rather thickly dusted with black scales, with three black dots, two costal,

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**Penthina glaciana* has been taken by Mr. F. G. Sanborn in considerable numbers during July, 1866, on the summit of Mount Washington, New Hampshire. Three varieties of the species occurred there, which correspond throughout with three similar variations of this same species which frequently occurred at Hopedale, Labrador, August 3, 1864. Two of the White Mountain specimens differed in having the transverse bands a little narrower; but on the whole, these differences do not amount to those usually presented by what are called by some naturalists "climatal varieties."

and one in the middle of the wing. This is succeeded by a darker band, and a broad, lighter space; on the outer fourth of the costa is an oblique band of even width, which crosses to the internal angle; in the middle of this white band is a narrow linear projection inwards under the subcostal. This band varies in sending in an acute point, or a simple linear elongation, and the white band may extend to the apex; it is marked on the costa, with three black dots. Hind wings cinereous as usual, more dusky at tip, fringe whitish, with two dusky lines at the apex, as on the fore wings. Beneath, uniformly dusky cinereous, costa on the outer half spotted with white and black, the three white spots at the apex being pupilled with black. Hind wings paler.

Length .30; fore wings .30 inch.

A common species, and closely allied to *P. glaciana*, but it is smaller, with narrower wings. The whitish line at the base of the fore wing is often obsolete, and the basal three-fourths of the wing are very uniform. It also differs in the outer white band, which varies greatly in shape, in being dentate inwards, not having the simple flexure inwards on the median that is present in *P. glaciana.*

Penthina tessellana *n. sp.*

♂, ♀. Cinereous with black patches and dots. Head and thorax dark, with whitish scales. Head blackish on the vertex, front paler, palpi dark, paler beneath; tips of second joint very square, truncate; third joint minute, acute, depressed. Fore wings checkered conspicuously on the costa with black, irregular bands and spots; a basal black band, growing pale inwards, with its outer edge irregular, enclosing a conspicuous white spot on the submedian vein; towards the costa, the edge becomes oblique, directed inwards on the costa. Beyond is a broad whitish band flecked with dark scales, which enclose a black dot on the costa. In the middle of the wing is a broad black band, limited on the costa, but below the middle of the wing formed of detached black patches, three in number, the outer one being near the internal angle. Beyond, on the costa, are three black checks, or square spots, alternating with white, the extreme apex is black, with a larger diffuse black conspicuous spot surrounded with white, this diffuse spot in the ♀ connects with the spot near the internal angle, forming an oblique submarginal line; edge of the wing dark, enclosing three white spots, which in fresh specimens form a short wavy white line; fringe uniformly dusky-brown, often interrupted with white. There is above a conspicuous white spot in the angle of the middle of the outer edge of the middle band.

Beneath, cinereous, checkered on the costa, hind wings paler. Legs cinereous, tarsi darker, ringed with whitish.

Length of body, ♂ .30, ♀ .28; fore wing, ♂ .30, ♀ .31 inch.

The female differs in having longer wings, while the male has a decidedly brown hue, with a white spotted fringe.

Its markings are not very characteristic, as the lines and spots vary greatly with the age of the specimens, and much rubbed specimens could scarcely be identified from the above description. The checkered costa, each white spot being pupilled by a black dot; the distinct white square in the middle of the wing, and the blackish apical and subapical patches, together with the angulated mesial band, will further serve to distinguish it.

A common species ranging from Caribou Island to Hopedale. It was most abundant at Square Island in July.

Penthina fulvifrontana *n. sp.*

♂, ♀. Head, including the front, tawny; palpi dark cinereous, white at tip and beneath, second joint scarcely so broadly truncate at tip, as in *P. tessellana;* antennæ dark brown. Thorax dark cinereous. Fore wings brown, with ochreous scales, and three transverse whitish bands; brown at base, becoming blackish towards the whitish band, especially on the costa, which band is of even width throughout, and angulated outwardly on the median space, and which on the costa encloses a brown dot. A broad, irregular brown band in the middle of the wing, becoming blackish on the costa, with ochreous scales in the middle; beyond is a whitish band which terminates in a rounded end on the submedian vein, and enclosing on the costa a triangular brown spot. Beyond, are two slight oblique (outwards) brown lines, the outer one the longer, and terminating on the lower two-thirds of the outer edge. Apex brown, fringe white, brown on the extreme apex, with a dark, basal, narrow line, obsolete towards the inner edge, and a few brown scales in the middle.

Hind wings dusky cinereous, concolorous with the abdomen, the tip of which is paler and concolorous with the fringe. Beneath, the body and both wings are dusky cinereous, with four pale costal spots on the outer half of the wing, alternating with square blackish spots. The fore legs are ringed with white; hind legs pale cinereous.

Length .26; fore wing .27 inch.

Sloop Harbor, common July 19. Strawberry Harbor, July 26. Tub Island, Aug. 7.

A common species, though less so than the foregoing. When the specimens are rubbed, the body is paler, and the ochreous scales are much more distinct; these, with the pale tawny front, will readily distinguish it from the other species.

Penthina murina *n. sp.*

Mouse color, dusted thickly with tawny scales, head and thorax darker. Palpi blackish towards the tip; third joint black. Antennæ brown, minutely annulated with white. Fore wings mouse color, with pale, tawny, obscure, small costal spots, and an obscure transverse, diffuse pale band, extending from just beyond the middle of the costa to the internal margin. There are no other markings. The apical portion of the costa is pale luteous, concolorous with the fringe, which on the outer half is dusky on the apex, sending an interrupted line towards the internal angle, with a similar dusky line at the base. Hind wings pale, becoming dusky towards the apex, concolorous with the hind legs. Abdomen dusky cinereous, anal tuft paler. Fore tarsi dusky cinereous, ringed with pale luteous.

Length of the body .30; fore wing .36 inch.

A common species at the Straits of Belle Isle. It is dull-colored mouse-brown, with lighter, fine scales, and paler spots on the fore costa, with a broad diffuse band from just beyond the middle of the costa to the internal margin, by which characters it may be known. It belongs to Lederer's genus Heterognomon, but does not differ generically from the other species mentioned above, referred to *Penthina*.

July 14. Caribou Island.

Penthina mœstana Wocke.

"Finland," (Wocke); Labrador, Möschler, l. c. p. 199.

Penthina turfosana H.-Sch.

Finland (Staudinger); Labrador, Möschler. p. 199.

"**Penthina** *n. sp.*" Christoph, l. c. p. 313. Möschler, l. c. p. 381.

"Near *Sauciana.*" Labrador.

Ablabia pratana Hübner.

"Labrador," Christoph, l. c. p. 313. Möschler, l. c. p. 380.

Anchylopera plagosana Clemens. Proc. Ent. Soc. Phil. p. 417. March, 1864.

Abundant on the exposed low plains on Caribou Island, occurring rarely at Square Island.

Halonota Packardiana Clem., l. c. 417.

Caribou Island. Common.

Antithesia bipartitana Clem. Proc. Acad. Nat. Sc. Philad. 1860. 346. (1861.) Proc. Ent. Soc. Philad. II. p. 418. March, 1864.

Specimens from Labrador are a little larger, but do not differ essentially from those from Maine. Caribou Island, common, but not found northward. It is evidently not a member of the Arctic fauna.

Grapholitha nebulosana *n. sp.*

Body blackish, wings clouded, dusky; head, palpi and thorax, uniformly dull brown, abdomen becoming more cinereous, wings very uniformly dusky, with no lines or spots, but a few scattered black dots on the costa, and dusky scales on the middle of the wing, gathered into an obscure, dark spot, which has a slightly tawny tinge, and forms a short, oblique, dusky band. The hind wings are paler than the fore wings. The two anterior pairs of legs are dusky, the tarsi ringed with white, while the hind tibiæ and tarsi are whitish silvery.

Length of the body .28; fore wing .36 inch.

It is not infrequent at Strawberry Harbor. July 26–30.

It may be recognized by the absence of very distinctive markings on the fore wings, and by the uniformly dusky body. A discal dot is sometimes present, communicating by a dark oblique line with a costal dot, and there are a few tawny scales on the apex. Fringe dusky, with a mesial white line, on the hind wings white.

TINEIDÆ.

Gelechia trimaculella *n. sp.*

♂. Blackish, especially the thorax, and the costa towards the apex of the fore wings. Front cinereous, palpi black above, beneath cinereous, terminal joint entirely black, wings dark cinereous with blackish scales; at the base, a narrow white line starts from the costa, and turns outwards at a right angle, following the submedian vein, and is then bent downwards at a right angle, terminating just below the submedian. In the middle of the wing is a short longitudinal white stripe, ending near the dark, obscure, discal dot. On the outer front of the wing is a costal and internal white, conspicuous straight spot, which is white at the end near the middle of the wing. Fringe dusky ashen, or whitish; the hind wings are of the same ashen hue. Legs blackish, annulated with white, hind tibiæ pale within.

Length .26; fore wing .34 inch.

Strawberry Harbor, the last of July.

In one specimen the fringe is whitish ashen, in the other it is dark, and the white markings are much more distinct. Beneath both wings are concolorous with the upper side of the secondaries, with a pale spot on the outer fourth of the costa.

Gelechia labradorica Möschler, Wien. Entom. Monatsch. VIII. p. 200. Taf. 5, fig. 17. ♂. 1864.
Moravian Missions, Labrador, Möschler.

Gelechia continuella Möschler, Wien. Entom. Monatsch. VIII. p. 200.
"Finmark," Staudinger. Labrador, Möschler.

Gelechia labradorella Clemens. Proc. Ent. Soc. Philad. II. p. 12.
Caribou Island, Labrador, March, 1863.

Gelechia brumella Clem., l. c. March, 1864. p. 416.
Caribou Island, July 20.

Tinea spilotella Tengström.

Tinea rusticella Linn. var. b. Möschler, l. c. VI. p. 139. VIII. p. 200. (not *Blabophanes monachella.*)

Christoph, l. c. p. 314.

Tinea biflavimaculella Clem. Proc. Acad. Nat. Sc. Philad. Sept. 1859. p. 257. Proc. Ent. Soc. Philad. III. p. 415. 1863.

"Okak, June." Christoph. Caribou Island, and Square Island, Labrador.

Ornix boreasella Clem., l. c. 416. 1863.
July 15. Caribou Island, Straits of Belle Isle.

Incurvaria labradorella Clem., l. c. 416. 1863.
With the preceding. Caribou Island.

Œcophora frigidella *n. sp.*

♂. Tawny, with a large black discal dot. Head and palpi pale tawny, of a little lighter hue than the wings. Body, including the abdomen, of a pale bronzed hue. Wings uniformly tawny, mottled with brown, especially towards the apex. A black dot on the submedian space in the middle of the wing, and a conspicuous large black discal dot on the outer third of the wing. Fringe bright tawny, like the wing, with dusky scales, and becoming paler below the apex. Hind wings much paler, but with a bronzed tinge. Fore legs cinereous, paler beneath, annulated with whitish, hinder pair pale tawny.

Beneath, dusky cinereous, apical half of costa tawny, hind wings dusky, paler behind.

Length .27; fore wing .30 inch.

Differs in its tawny head, the mottled brown spots on a tawny ground, on the outer half thickly mottled with black-brown, especially dark about the discal region.

Caribou Island and Square Island, Labrador.

Œcophora *sp.*

Another species was found at Hopedale, but my specimens are unfit to describe. It is allied to the *O. juniperatella* and *O. betulella* of Europe.

Glyphipteryx *sp.*

A specimen, probably of this genus, occurred at Caribou Island.

ADDITIONS TO A LIST OF BIRDS SEEN AT THE BAHAMAS. BY HENRY BRYANT, CURATOR OF ORNITHOLOGY, BOSTON SOCIETY OF NATURAL HISTORY.

In the year 1859, I visited the Bahama Islands, but was unable from want of time, to make as thorough an examination of them as I had hoped. At that time I was frequently told that Inagua, one of the largest and the most southerly of the group, was extremely fertile, that it contained forests of large trees and rich savannas. As this island is apparently detached from the rest of the group, and lies so much farther south, and as it is represented on many maps as hilly or mountainous, I thought that it was very probably of a different geological formation from the other islands, and consequently possessed of a different fauna. In order to determine these points, I visited it during the past winter, touching on my way at such islands as I had not previously visited; all those, including Watling Island, Rum Cay, Long Island, Crooked Island, Ackland Island and Fortune Island, presented, as I had expected, the same formation as the more westerly and northerly Cays; and to my great disappointment on arriving at Inagua, I found that that garden of Eden was, if any thing, more desolate and dreary than the others, and presented precisely the same geological formation. The fertile prairies, of which I had heard so much, were salt plains covered with a coarse grass, dotted here and there with clumps of stunted trees, and scarcely elevated above the level of the salt lake, or salina. The only difference between them and those on other Cays, was their greater extent. These plains are undoubtedly the remains of lagoons, formed by fringing reefs filled up by the action of the winds and waves. Watling Island exhibits this process in the most striking manner, as it is, strictly speaking, merely a narrow margin of an interior lagoon, much deeper than the salt lake at Inagua.

The interior of Inagua has never been thoroughly explored, and little is known of its eastern shore. The principal settlement, called Mathewston, is at the southwest end of the island, and a place of some importance from the quantity of salt which is made in the neighborhood, and which, if labor could be procured, could be increased to almost any extent. I am much indebted to Mr. Daniel Sargent, the American Vice-Consul, at this port, for much valuable information concerning the Bahamas, and to himself and amiable family for making my visit so agreeable that I left the island with much regret.

The most curious feature of the island is the salt lake or salina. This is the remains of the original lagoon which once occupied the greater part of the island, and which has been gradually filled up so evenly that the portion which still remains is nowhere more than a few feet in depth. In crossing one part of the lake, a distance of about twelve miles, the water was nowhere over two feet in depth, and for nearly the same distance in another direction, not over three, and this only for a very short distance. Almost everywhere it varied from ten to twenty inches. In crossing at its widest part, the shore would be invisible if it were not for the number of small islands scattered about it. The bottom varies from a hard rock to a soft mud. I saw no crustacea in the lake, or fish, but large quantities of small mollusks; of three species, two bivalves and one univalve. The avifauna of the island presents the same general character as observed in the other Cays, and though I did not obtain all the species previously found, I have no doubt that a longer stay would have enabled me to find them. The following list includes only such birds as were not seen by me during my first visit, or as presented some new feature that seemed worthy of notice. Those seen at Inagua are marked with an *, those seen at Nassau with a †.

Falco.

† * **Falco peregrinus** Linn. §

In descriptions of hawks, it is generally stated that they kill their prey at once. This is not always the case. While crossing the lake at Watling Island, I saw a Duck Hawk seize a Blue-bill (*Anas marila*), which at my approach it dropped. The poor duck presented a most horrible sight, the hawk having stripped the skin completely from the head and upper part of the neck, without apparently inflicting any other injury, as the duck was able both to swim and dive with ease.

Buteo.

† * **Buteo borealis** Linn.

Two specimens, one at Nassau, the other at Inagua; this is probably the reddish hawk mentioned in my previous list.

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§ I am satisfied that the American Peregrine Falcon should not be separated even as a variety from the European bird, or from the *Falco nigriceps* of Cass. A pair in the cabinet of the Smithsonian Institution collected by Mr. McFarlane in the Hudson's Bay country, represent typically the two styles—the small European Peregrine and the larger *anatum*.

Strix.

* † **Strix flammea** var? Probably found in all the larger islands, as it was accurately described to me everywhere. I saw one specimen at Inagua, and one at Nassau. At Inagua, I also saw a small owl flying several times, but could not succeed in shooting it.

Circus.

* **Circus hudsonius.** A single specimen in immature plumage.

Psittacus (Chrysotis.)

* **Psittacus collarius** (var. *bahamensis.*) Abundant. It breeds at Fortune Island, Auckland Island and Inagua. The white of the head extends across the forehead as far up as the centre of the eyes, and on the side of the head, so as to nearly cover the ear coverts.

Coccygus.

† **Coccygus minor** Gml. Several specimens; one with the tail in immature plumage.

Picus (Sphyropicus.)

* † **Picus varius.** In consequence of the singular habit of destroying the bark of trees which this bird exhibits at the West, I was led to look for it carefully, and the result was that I found it abundant wherever I went, and the trees everywhere marked with the circular rows of small holes seen in the Eastern States; but in no case did I see large pieces of the bark gone, or even small holes with perpendicular sides, as is the case in the neighborhood of Racine, Wisconsin. The stomachs of several specimens examined contained insects, and in some instances small berries; in one, nothing but small green aphides, and in another small ants.

Trochilus.

* † **Trochilus evelynæ,** Bourc. (*Trochilus bahamensis*, Bry.) I was informed that at Inagua there was a large species of humming bird, which I thought would probably prove to be a *Lampornis.* I however saw no other species than the present. These birds appear to be extremely local. On taking up my quarters in the railroad car, which performed the office of hotel at Inagua, I was delighted at what I thought was the abundance of humming birds in the neighboring yard. I killed a few, and the next morning there were none to be seen. This, I thought, was caused by a cow having eaten up during

the night, all the flowers on which they were feeding. In the course of a few days, the flowers again made their appearance, but not the humming birds. Sometime after, I was told of a meringa tree on which they were feeding in great numbers. The tree was only about three hundred yards from the place where I was staying, and I immediately went to it, and in a short time killed several; but on visiting it again at different times, saw scarcely another bird. All humming birds that I have ever observed feed equally on insects and honey, and though they generally procure insects from flowers, this is by no means universally the case. I should think that fully one-half of the humming birds killed by me had eaten sufficient honey for it to run out of the bill when the bird was held up by the foot.

Certhiola.

* † **Certhiola bahamensis,** Reich. (*Certhiola flaveola*, Bry.) As there were no fruit trees at Inagua, these birds were compelled to procure their food from the same flowers as the humming birds, and this was apparently very similar. Frequently several drops of honey would run from the bill. The stomach, in every instance, contained insects, and in one or two instances, I also found a few small seeds surrounded with a greenish pulp. Gosse, in his description of *Certhiola flaveola*, says that it is frequently driven away from the flowers by the humming birds. The present species is not so easily alarmed; but, on the contrary, almost always drives away the humming birds that come to the flowers on which they are feeding.

Tyrannus (Melittarchus.)

* **Tyrannus magnirostris.** One male shot on the Savanna. The stomach was filled with wasps.

(Pitangus.)

† **Tyrannus caudifasciatus.** One specimen. The bird determined by me in the previous list as *caudifasciatus*, was decided by Prof. Baird and myself to be of a different species (*Pitangus bahamensis*) and described as such in the Proceedings of the Society (Vol. IX., p. 279.)

Tyrannula (Myiarchus.)

* † **Tyrannula stolida** (var. *lucaysiensis.*) This variety (?) is larger than either the Jamaican *stolidus* or Cuban *sagræ*, but it resembles *sagræ* most in color. Several specimens. ♂ adult. Length of wing, 90; of tail, 82; of bill along ridge, 21.§ Above brownish-

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The measurements are in millimetres.

ash, slightly olivaceous; this last color most perceptible on the nape. Head dark rich brown, with the margin of the feathers slightly ferruginous, as are those of the upper tail coverts. Wings and tail dark brown. The tips and external margins of middle and greater coverts whitish, forming two very distinct bands; margins of second ones and tertiaries white, quite pure and broadest on the inner ones; all the primaries, except the first, distinctly margined with rufous, occupying about one-third of the web next the base, and gradually narrowing to the sinuation when it disappears; tail with all the feathers except the two internal ones margined with rufous on the inner web, occupying about one-third of the web in the external feather, and gradually becoming brighter and wider on the inner ones, until it occupies a little more than half. Beneath pale cinereous, with the centre of abdomen faintly yellowish.

Sylvicola (Parula.)

* † **Sylvicola americana.** Abundant.

(Dendrœca.)

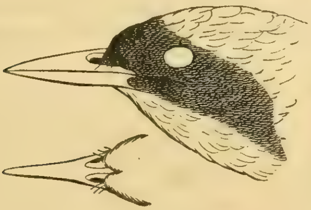
† **Sylvicola pinus.** One specimen.

† **Sylvicola æstiva.** Two specimens, which belong to this species, if the distinctions pointed out by Prof. Baird between this and the next can be relied on.

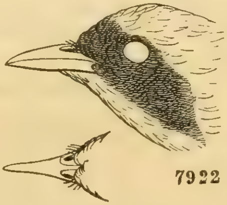
* **Sylvicola petechia.** I did not see this species at Nassau, though it doubtless could be found there; at Inagua it was quite abundant both among the mangroves and in the clumps of trees in the Savanna.

Geothlypis.

† **Geothlypis rostratus.** Three specimens, all males. During my previous visit I saw great numbers of the common species, *Geothlypis trichas*, but none of the present. The difference between the two birds will be best seen by the wood cut, which gives outlines



Geothlypis rostratus.



Geothlypis trichas.

of the head of the largest specimen of *G. trichas* in the cabinet of the Smithsonian Institution, compared with that of the present species. Besides the great difference in the bill, the wing is rounder, the tail much broader, and the whole bird much larger. Length, 136; wing, 65; tail, 59; tarsus, 22.5; bill along ridge, 17. Above, with closed wings and tail, bright yellowish-olive; a fillet of black of equal width extends from a little behind the ear coverts round the forehead, including the eyes, and reaching the lower edge of lower mandible. This black is bordered posteriorly with pearl-grey, which is gradually shaded into the olive of the back. Beneath bright chrome-yellow, without the white on the centre of abdomen always found in *G. trichas*, the flanks gradually shaded with olive into the color of the back. The stomach and æsophagus of one contained the head and body of an *Anolis*, which without the tail measured ten inches and a half in length, showing rather a carnivorous propensity for a bird of this family.

Seiurus.

† **Seiurus aurocapillus.** Common.

† **Seiurus noveboracensis.** Common. These two birds are called night walkers by the inhabitants.

Turdus (Mimokitta.)

† **Turdus plumbeus** Lin. I tried very hard to procure additional specimens of this interesting bird, but without success. I was told by the inhabitants that after the sapodillas were ripe, they came into the settlement and could be easily killed.

Mimus (Leucomimus.)

* **Mimus polyglottus** (var. *bahamensis*)? Very abundant at Inagua, but not seen by me in any other island. This variety (?) comes in between *dominicensis* and the typical *polyglottus*; the difference between *polyglottus* of the United States, *bahamensis*, *dominicensis*, *cubanensis*, *portoricensis* and *orpheus* are so slight, that though it is possible to assign an average to each variety, it is, I think, impossible to determine with absolute certainty to which variety any single specimen belongs, excepting by a knowledge of the locality from whence it comes. The most readily distinguished is the typical *orpheus*, and mistakes would not often occur in determining such specimens.

(Skotiomimus.)

* † **Mimus bahamensis** Bry. Very abundant at Inagua, but not so common as the preceding species. Prof. Baird, in his Review

of American birds, points out some differences between this bird and *Hillii.* On examining ten specimens of the present bird, and eighteen of *Hillii,* I found no differences that would not probably disappear with a larger series. My largest specimen of *bahamensis* is as large as the largest *Hillii,* and the smallest *Hillii* is nearly as small as the smallest *bahamensis.* The length of the tail varies very much in both, at least .25. The difference between the central and external tail feathers varies in *Hillii* from 18 to 26 mill.; in *bahamensis* from 16 to 24. The comparative differences in the length of the primaries can be found in birds from both localities. The fourth and fifth are nearly equal and longest; the third slightly shorter; then the sixth, seventh, second and eighth. The white appears to occupy rather more space on the tail feathers of *Hillii,* but its greatest extent is only 17 mill., compared with 15 mill. in *bahamensis.* The Jamaican bird is not whiter beneath, and the faint streaks on the centre of the feathers of the breast are found in about a third only of the birds from either locality, and are quite as distinct in the Jamaican as in the Bahaman birds. Prof. Baird is quite right in comparing it with *M. thenca* instead of *M. saturninus,* to which Cabanis compared *M. Gundlachii,* which is probably the same bird.

(Galeoscoptes.)

* † **Mimus carolinensis.** Abundant.

Polioptila.

* **Polioptila cærulea.** I first met with this bird at Fortune Island. At Inagua it was extremely abundant; scarcely a bush could be found without one or more of them, and the males were singing with as much animation as in the middle of summer. I think I saw more individuals of this species every day at Inagua, than I had ever seen in the whole course of my life in the United States.

Hirundo.

* **Hirundo horreorum.** According to Mr. Sargent, a very large flock of these birds visited the island some years since, and remained several days. He had never seen the Bahama swallow there.

Totanus.

* **Totanus melanoleucus.** Abundant.

* **Totanus flavipes.** Abundant.

Tringa.

* **Tringa maculata.** Abundant.

Phœnicopterus.

* **Phœnicopterus ruber.** Immense numbers of these birds can be seen in the lake. I visited their breeding places twice, but unfortunately they had not commenced laying at the time of my departure, early in April, and I only saw the remains of last year's nests. Their principal food is a small bivalve shell found everywhere in the lake. They also eat small fish which they catch in the same way as the Wood Ibis does, by trampling in the mud until the water is so turbid as to be opaque, and the fish can not see them. I shot several thus employed, the æsophagi and stomachs of which were filled with small fish, about an inch in length. My friend, Mr. Sargent, was so kind as to send me a large number of eggs of this bird. These resemble very nearly those of the gannet, and specimens can be selected which I think cannot be distinguished from eggs of that bird. Three specimens selected as extremes, measure 97×54, 91×58, 88×58 mill.

Dendrocygna.

* **Dendrocygna arborea.** Young were brought to me in March, in the downy state, and partially fledged early in April.

Anser.

* **Anser cœrulescens.** Mr. Sargent states that a small flock of white or adult birds of this species visited the island several years ago, and were all killed by the inhabitants.

Mr. W. T. Brigham exhibited a distorted skull of a child which he had brought from the Hawaiian Islands, remarking that the practice of compressing by boards or bandages was only carried on among the Hawaiians during early childhood; the distortion afterwards apparently passed entirely away, since the skulls of adults were remarkably symmetrical. Hundreds of skulls had come under his observation, but while he had seen many children's skulls distorted, he had never observed any signs of it in those of old men. The compression was frequently made with curved and carved boards, so as not to produce a flat surface. It was related that the native nurses attempted to practise the same custom on the children of the first missionaries who came there.

Dr. J. Wyman remarked that in the present instance the compression did not appear to have been produced by bandages, and the whole head was shoved upon one side; he had a similar skull from this vicinity.

Dr. J. B. S. Jackson stated that such appearances were not uncommonly found in Switzerland, among skulls of persons affected by the goitre.

Mr. Brigham stated that the teeth of the Hawaiians of the present day were very seldom decayed; but he had found among some ancient skulls one which had two of the lower incisors decayed around the gum in front; the teeth of the natives at present are very strong.

A suite of specimens of *Gnaphalium leontopodium*, exhibiting the changes which the plant underwent in a series of three years, on transportation from its natural habitat, a height of six thousand feet in the Tyrolese Alps, to one of two thousand feet in the mountains of Saxony, was presented by Mr. S. H. Scudder.

The Custodian stated that while, previous to the opening of the Lafresnaye Collection of Birds, the average number of visitors on public days was from one to three hundred, it was now from five to nine hundred; two hundred persons had been counted upon the Hall floor at one time.

Professor Steenstrup of Copenhagen, and Professor Siebold of Munich, were elected Honorary Members; and Dr. Loew of Meseritz, Prussia, and Mr. Andrew Murray of London, Corresponding Members.

Dr. Edward P. Colby and Messrs. Joseph R. Churchill and R. C. Greenleaf, Jr., of Boston, were elected Resident Members.

November 7, 1866.

The President in the chair. Fifty members present.

Dr. C. T. Jackson exhibited a specimen of meteoric iron which he had received from Rev. Mr. Thompson of Colorado. It was a fragment of one found by Mr. Arlsa on Bear River, nine miles southwest from Golden City, Colorado.

This meteoric iron had a crust on one side of the specimen which consists of protosulphide of iron. It was originally a bi-sulphide, but was decomposed by the fire used in heating it, for the purpose of cutting off a piece, by the people in Colorado.

Specific Gravity of the clean metal 7.692

COMPOSITION.

Metallic Iron	90.650
" Nickel	7.867
" Tin	0.020
" Cobalt	0.010
Schreibersite or Iron Phosphorus and a little Nickel and Cobalt. Insoluble.	0.950
	99.497

On a polished section of the metallic mass, diluted nitric acid brings out very sharp and well-defined Widmannstätian figures, in the forms of nearly equilateral triangles.

The mass was cut from an immense meteorite, said to be two feet in diameter. It is noticed by Prof. C. U. Shepard in the last September number of the American Journal of Science, but no analysis was given.

Prof. Shepard has purchased this meteorite, and daily expects to receive it.

Dr. J. C. White illustrated by drawings upon the blackboard some remarks upon an Entozoon or parasitic worm found in the human intestines, and called *Ancylostomum duodenale.*

The worm belongs to the nematoid or round worms such as *Trichina* and others, and is somewhat allied to *Strongylus*, having been formerly described as one. It was first found in Milan in 1838, and afterwards in Egypt, where a peculiar and grave form of anœmia had long prevailed, which affected one-fourth of the population, and was called Egyptian chlorosis; but its nature and cause remained unknown till 1852, when Griesinger in his travels made a post-mortem examination of one of these fatal cases at Cairo, and found the jejunum and duodenum filled with fresh blood, and thousands of these little worms attached to the mucous membrane and filled with blood. A form of anœmia, with symptoms similar to those produced in Egypt, has long been prevalent in Brazil, but till within a year it was not known that this Entozoon was the cause of it, when Dr. Wucherer of Bahia discovered them in the jejunum of a human subject and verified his discovery in May last. Specimens obtained from Dr. Walbaum of Bahia, and brought to this country by Mr. Sceva, were exhibited by Dr. White.

Mr. W. T. Brigham presented a dried specimen of the male blossom stalk of the date palm, taken from a tree twelve years old, and measuring eighteen feet to the base of the leaves. This tree produced eight other blossoms, and the flowerets on each scape were between eight to nine thousand. The outer envelope is quite hard and fibrous, splits into two nearly equal parts, and is persistent; when fresh it exhales a strong odor of rosewood.

He also exhibited an ancient Hawaiian stone adze, of a peculiar shape, presented recently by the Rev. Edw. Johnson. These adzes were in universal use in ancient times, and even now the old natives prefer them in finishing the interior of canoes, cutting with them a delicate shaving from hard wood. The material of the adze exhibited was a compact lava found on Mauna Kea at an altitude of more than ten thousand feet, and this specimen had been split out and rubbed to an edge without any iron tools.

On motion of Dr. J. C. White, the following Resolutions were passed:—

Resolved, That the Boston Society of Natural History recognizes, and would express its grateful appreciation of, the great value of the gift made by Mr. George Peabody to Harvard University for the foundation of a Museum and Professorship of American Archæology and Ethnology, and the advantage which is sure to follow from its wise provisions to the interests of natural science in this country.

Resolved, Also, that it acknowledges with pleasure the recognition on the part of Mr. Peabody of the relation of the Society to this important department of Natural History in the selection of its President, Jeffries Wyman, M. D., as one of the trustees and directors of this munificent endowment.

The Secretary was instructed to send a copy of these Resolutions to Mr. Peabody.

The President stated that while American Archæology was specially mentioned in the foundation of Mr. Peabody, it was not intended to restrict the object to this, but to embrace in general the sciences of Archæology and Ethnology; and that he believed the foundation to be the most munificent of its kind in the world.

Dr. B. Joy Jeffries presented the following table, giving the average age, height and weight of forty members of the Independent Corps of Cadets, recorded at camp at Nahant, August, 1866.

Average	Age, 27.02.	Heaviest	Member,	208 lbs.
"	Height, 5 ft., $7\frac{2}{3}$ inches.	Oldest	"	51 yrs.
"	Weight, 146.15 lbs.	Tallest	"	6 ft., $1\frac{1}{2}$ inches.

On motion of Mr. C. K. Dillaway, the President nominated Mr. R. C. Greenleaf, Dr. J. B. S. Jackson and Mr. C. J. Sprague as a Committee to present to the Society at the next meeting the name of a candidate for the office of second Vice President, now vacant by the death of the late Dr. A. A. Gould.

The Librarian announced, that by vote of the Council, the Library would be open hereafter from 10 to 1, and from 2 to 5.

Rev. Titus Coan of Hilo, Hawaiian Islands, and Professor O. C. Marsh of Yale College, New Haven, were elected Corresponding Members.

Dr. Stephen W. Bowles of Boston, and Mr. J. W. Ward of Cambridge, were elected Resident Members.

The following minutes of two previous meetings of the Section of Mycroscopy were directed to be printed in the Proceedings.

Section of Microscopy. Nov. 8, 1865.

The Curator in the chair. Fourteen members present.

Mr. R. C. Greenleaf exhibited under the microscope fractures made on a plate-glass surface, and remarked upon the optical effects thus produced.

He also gave the following list of Diatomaceæ found in a deposit of remarkable purity, by Col. Crockett, in a peat swamp near Lake Winisquam in Laconia, N. H., and presented two slides of mounted specimens. This deposit was a very valuable fertilizer, and had been used with great success on the surrounding land.

Stauroneis phœnicenteron.
" Bailyii.
" gracilis.
Pinnularia major.
" viridis.
" stauroneiformis.
" nobilis.
" lata.
" mesolepta.
" divergens.
Himantidium bidens.
" arcus.
Himantidium gracile.
Navicula rectangulata.
" firma.
" *sp.*
Nitzschia scalaris.
Gomphonema acuminatum.
Tabellaria fenestrata.
Cocconema lanceolatum.
Cymbella cuspidata.
Melosira ? *sp.*
Encyonema *sp.*
Sponge spicules.

Mr. Charles Stodder reported upon the collection of Diatomaceæ from the alpine summits of the White Mountains of New Hampshire, recently made and presented by Dr. Bemis.

The forms found by Dr. Bemis upon the summit of Mount Crawford, *Navicula dicephala* Ehr., were very minute. This peculiarity was also noticed in those found by Dr. A. A. Gould upon the summit of Mount Mansfield; those occurring upon the summit of Mount Washington, obtained by Mr. Greenleaf, were found to be very minute forms; such as *Odontella*, *Denticula*, etc.

He had identified *Stauroneis gracilis* and *Pinnularia viridis* from "South Field" and *Flabellaria ventricosa* Kutz, *Fragillaria virescens*, *Himantidium* sp., *Navicula rhomboides* (small variety,) and a species of *Synedra* from a Sphagnum swamp in Hartt's Location, N. H.

Section of Microscopy. October 10, 1866.

The Curator in the chair. Nine members present.

The following paper was presented:—

On Infusorial Earth from Peru. By Charles Stodder.

In July, 1865, Dr. C. F. Winslow exhibited to the Society a specimen of "Infusorial earth" from a locality discovered by himself about seventy miles south of Paita, Peru. Dr. Winslow describes the locality as a plain about fifteen miles from the sea, and separated from the coast by a range of hills of slate rocks four to six hundred feet high. Within the plain, and near the base of the hills, is an extensive depression about two hundred feet deep, with nearly vertical walls; his opinion being that the depressed part has subsided from the general level of the plain. He estimated the surface of the depressed portion to be about the sea level, or possibly lower. The surface was covered by salt. He considers that the whole plain has been covered by the sea in recent geological times, but whether there is any opening through the hills by which the sea could have obtained access, he did not say. The earth was taken from a stratum two to four feet thick, cropping out of the walls of the depression described, about fifteen feet below the level of the plain. The superincumbent strata contain recent shells, bones of cetacea and pebbles, followed by one to two feet of yellow sand, and then the deposit from which the specimen was taken. All the fossils being recent, according to Dr. Winslow, the deposit may be considered as Post-tertiary.

The earth somewhat resembles earths from Monterey, California. It is of a light yellowish color, and rather firm consistency; it crumbles to a coarse powder on the application of a little force, but the component organisms of the powder are cemented so firmly, that it is very difficult to reduce it to its ultimate constituents. It is almost all organic, the quantity of sand being but a small percentage, with barely enough lime to produce a slight effervesence with acids.

Mr. C. G. Bush has coöperated with me in the examination of the organisms, and a large proportion of the species to be named were found only by him.

The microscopic organisms are *Rhizopoda* and *Diatomaceæ*.

Rhizopoda.

The *Polycistinæ* are moderately abundant, but nearly all only fragments, which would not afford specific characters, even if there were any reliable authority for classifying them.

The *Dictyocha* are represented by several of Ehrenberg's species. They were placed by Ehrenberg in his heterogeneous group of Polygastric Infusoria, and with, or near to, the *Diatomaceæ;* other naturalists have been unable to see any affinity to the *Diatomaceæ*, but could not assign them any other place. Recently Dr. Wallich has claimed that they belong to the *Rhizopoda*. I have not seen his original paper, so that I do not know his reason for this classification, but it seems to be most probably the correct one.

I have identified the following species: *Dictyocha speculum*, *Dictyocha fibula*, and a species of *Mesocena*, which has six external teeth and six internal teeth. Some others that do not correspond exactly to any of Ehrenberg's species, were also found.

There are several varieties of sponge spicules, not very abundant. It is not worth while to describe the variation in shape of these things, until some one has made a study of them, and shown the connection between forms of spicula and specific character of the sponge.

Diatomaceæ.

This order of *Algæ* is well represented, constituting eight to nine-tenths of the bulk of the deposit. The combination of species is quite remarkable, in some respects resembling the Monterey deposits. The most abundant form, and the largest also, is *Coscinodiscus asteromphalus* Ehr., a beautiful species, varying from .0033 to .01 of an inch in size. It is so plenty that it must, I judge, compose about one-half of the whole bulk of the deposit. There are a vast number of very minute forms, both circular and bacillar, so minute that even with a power of thirteen hundred diameters, no reliable specific characters can be demonstrated. Such small forms are not uncommon in other fossil deposits, but here they are far more numerous than I have ever met with elsewhere, as in numbers they exceed all the others. Several specimens of *Euodia gibba* have been found. This is a genus named by Prof. J. W. Bailey from a form found by him in the Atlantic Ocean; not published by him, but by Ralfs. I do not know that it has ever been found by any other writer, unless the *Hemidiscus* of Wallich is the same. Some observers have found it in muds from the Gulf of Mexico.* Some of the specimens here are identical with Bailey's, but others are more convex on the least convex side, and want the constriction near the ends. I am, however, unwilling to make a species on such variations of outline.

The species of *Actinocyclus*, *Actinoptychus* and *Omphalopelta* are abundant, but the specific characters of the three genera are often so indefinite that it is difficult to assign names to them. The list of other genera and species found, is quite large, but with the remarkable fact that the individuals are very rare; of the list more than one-half is represented by a single specimen only, and of the other half but very few have been found; of some not more than two. No other fossil deposit that I have examined has ever given such a result — so many very scarce forms. Not less remarkable is the geographical distribution of these forms. They have representatives in California, Virginia, Florida, Scotland, Spain, the Pacific, Atlantic and Indian Oceans. It is rather remarkable that several species have been published only very recently by the late Dr. R. K. Greville. One form which I found abundantly a year ago, and have since been trying to ascertain if it had been described, proves to be *Coscinodiscus Lewisianus* of Greville—published in the last number of the Journal of the Microscopical Society, since Dr. Greville's decease.

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* Since the above was written, it has also been found by Mr. Greenleaf in soundings in the Gulf Stream off Cuba, with variations from Bailey's typical form similar to those mentioned here.

Here let me pay a tribute to the memory of one of the most accomplished Diatomists of our day. Having attained a high reputation as a botanist, for some years he appears to have given his whole attention to the diatoms. After drawing most of Prof. Gregory's species, since Prof. Gregory's death, he has published more species than any other writer on the subject. The clearness of his descriptions, and the beauty and fidelity of his drawings, have been universally admired. There may often be a question as to the validity of his species, as there is in many other cases, but of the value of his contributions to the science, there can be no doubt. His loss will be lamented by every lover of these beautiful "gems of the ocean."

ANGULIFEREÆ.

Euodia gibba *Bail.*
" " *var.*
Triceratium condecorum.
" articum *Bri.* = T. Wilksii *Bail.*
Triceratium Favus. (=? T. punctulatum.)
Triceratium intricatum *West.*
" cinnamoneum *Grev.*
Amphitetras ornata.

EUPODISCEÆ.

Aulacodiscus crux, with three feet.
" formosus.
Auliscus cælatus *Bail.*
" macræanus *Grev.*
" moronensis *Grev.*

BIDDULPHIEÆ.

Biddulphia pulchella.
" aurita.
" Toumeyii *Bail.*

LICMOPHOREÆ.

Climascosphenia moniligera.

STRIATELLEÆ.

Grammatophora serpentina.
" macilenta.

FRAGILARIEÆ.

Plagiogramma Grevillii *Ralfs.*
" validum *Shadt.*

SURIRELLEÆ.

Tryblionella augustata *W. S.*
Surirella fastuosa.
Campylodiscus bicostatus.

COSCINODISCEÆ.

Actinocyclus Ehrenbergii.
Actinoptychus superbus *Bail.*, ined.
Actinoptychus senarius.
Coscinodiscus asteromphalus.
" lineatus.
" subtilis.
" radiatus.
" Apollinis.
" concavus.
" Macræanus? *Grev.*
" Lewisianus *Grev.*
Arachnoidiscus ornata.

Omphalopelta versicolor.
Asterolampra Marylandica.
“ Moronensis ? *Grev.*
“ Darwinii. “
Asteromphalus arachne.
“ Brookei.
“ Shadboltianius.
Odontodiscus *sp.?*

MELOSIREÆ.

Mastogonia sexangula.
“ actinoptychus.
Stephanogonia polygonia.
Melosira sulcata (=M. marina.)
Pyxidicula crux.
“ —— ?
Xanthiopyxis globosa.
Xanthiopyxis oblonga.

CHÆTOCEREÆ.

Dicladia capreolus.
Chætoceros —— ?

COCCONEIDEÆ.

Cocconeis scutellum.
“ —— ?

NAVICULEÆ.

Navicula californica.
“ bombus.
“ lyra.
Pinnularia peregrina.
Pleurosigma validum.
Toxonidia Gregoriana *Donk.*

Section of Microscopy. November 14, 1866.

The Curator in the chair. Seventeen members present.

Mr. R. C. Greenleaf read a paper on the Diatoms, and other microscopic objects found in soundings from the Gulf of Mexico, between Sand Key and El Moro, made by Henry Mitchell, Esq., of the United States Coast Survey.

Mr. Mitchell was engaged the last winter in making a survey in the Gulf of Mexico, from Sand Key to El Moro, and kindly furnished me the dredgings from some of the deepest soundings which he made. These gatherings were cleaned by our associate member, Mr. Charles G. Bush, in an admirable manner, separating the calcareous shells, or *Foraminifera*, of microscopical proportions, found at these great depths, from the still more minute silicious forms, consisting of *Polycystina*, *Diatomaceæ*, and sponge spicules. This renders the study far more pleasant and satisfactory than having them placed together on the same slide.

These gatherings are not rich in Diatoms, but many of the specimens are very beautiful of their kind. I find some of the forms published by Prof. Gregory in his papers on Glenshira Sands, in the Quarterly Journal of Microscopical Science, and some of the forms published more recently in the same Journal, by Dr. Greville.

I have not found any decidedly new species, although I have examined with great care more than twenty slides from the different dredgings. One or two forms are new to me, but I consider them as varieties of species already published.

And here, let me say, the student in this department of Natural History is sorely perplexed. Many forms published as new species, certainly vary less from those previously figured and described, than many acknowledged as varieties do from the type species. For example, the varieties of *Navicula didyma* differ more from the typical form, than many of the forms claimed as new species, do from the original of *Navicula didyma.* The same difficulty arises in the study of many other genera of these most beautiful of all microscopical objects.

I hope some earnest student in this department will find time to engage in the most difficult task of reviewing all that has been published, rejecting all superfluous genera and species, and thus bring order out of great confusion, and make the study of these minute objects comparatively easy.

The diatoms most abundant on these slides are *Navicula lyra*, *Triceratium Favus*, *T. obtusum*, *Hemidiscus cuneiformis* (= *Euodia gibba*) and small *Coscincodiscea.*

Sponge spicules are very abundant and perfect. I recognize many of Ehrenberg's figures.

Minute calcareous shells, or *Foraminifera*, are very abundant, but not in great variety. Those particularly noticed are *Planulina* and *Rotalia* of Ehrenberg. *Polycystina* are also abundant, but much broken; a few forms are quite perfect.

In all these soundings are found nearly the same forms of each family. I have only attempted to catalogue the diatoms, not having studied the others enough to verify or name them.

FROM A DEPTH OF FOUR HUNDRED AND THIRTY-TWO FATHOMS.

Triceratium Favus.
“ obtusum.
“ unguiculatum *Grev.*
“ spinosum *Bail.*
“ venulosum *Grev.*
Biddulphia *sp.*
Campylodiscus Kutzingii ? *Bail.*
Nitzschia panduriformis.

Eupodiscus punctulatus.
Navicula prætexta.
“ lyra.
“ clavata.
Navicula Smithii.
Pleurosigma *sp.*
Cocconeis pseudomarginata.
“ distans.

Dictyocha *sp.*
Hemidiscus cuneiformis,(=Euodia gibba.)
Stictodiscus californicus.
Actinopticus undulatus.
Asterolampra *sp.*, (broken.)
Polycystina, Sponge spicules and shells, abundant.

FROM A DEPTH OF EIGHT HUNDRED AND FIFTY-THREE FATHOMS.

Triceratium Favus.
“ alternans.
Navicula lyra.
“ prætexta.
“ Hennedyi.
“ Smithii.
“ didyma.
“ nitida.
Campylodiscus.
Hemidiscus cuneiformis.
Amphitetras *sp.*
Nitzschia panduriformis.
Asterolampra moronensis *Grev.*
Stictodiscus californicus.
Podosira maculata.
Pleurosigma *sp.*
Cocconeis distans.
“ *sp.*
Coscinodiscus lineatus.
Sponge spicules, abundant.
Polycystina “
Foraminifera “

FROM A DEPTH OF EIGHT HUNDRED AND TWENTY-EIGHT FATHOMS.

Triceratium Favus.
“ obtusum.
Navicula didyma.
“ lyra.
“ Hennedyi.
“ Smithii.
Podosira maculata.
Hemidiscus cuneiformis.
Amphitetras ornata.
Eupodiscus crassus.
Biddulphia *sp.*
Nitzschia panduriformis.
Plagiogramma *sp.*
Coscinodiscus *sp.*, frequent, very small.
Navicula *sp.* (near granulata *Bail.*)
Surirella fastuosa.
Dictyocha *sp.*
Sponge spicules, Polycystina and Foraminifera.

In this gathering are found broken diatoms, evidently new, but too much broken to make out any determined forms.

FROM A DEPTH OF FIVE HUNDRED AND EIGHTY-THREE FATHOMS.

Pleurosigma Balticum.
Navicula Hennedyi. *var.*
Cocconeis distans.
Triceratium obtusum.
Glyphodesmis *sp.*

This gathering is very poor in diatoms. Many fine specimens of shells and sponge spicules occur.

I have given drawings of several new forms found in this gathering. Some of them might be claimed as new species, but I prefer referring them all to one or two species already established, *Navicula lyra* and *N. prætexta.*

These drawings will serve to illustrate the remarks made in reference to the difficulty in the study of diatoms, from the many species named by microscopists, which really ought to be called varieties of species already published.

The great similarity in the structure of these forms is very noticeable, the blank space in the centre being more or less developed, the striation on each side of the central line, and the striated margin or border broad, as in the type form of *N. lyra*, or narrow, as in *N. prœtexta.*

If the student will examine the published forms of *N. lyra*, *N. spectabilis*, *N. prœtexta*, *N. clavata*, *N. nebulosa* and *N. Hennedyi*, he can not but see the great resemblance there is in structure one to the other. Most of these forms can be found in Prof. W. Gregory's paper on "Marine Diatomaceæ, found in the Firth of Clyde and in Loch Fine," published in the transactions of the Royal Society of Edinburgh, 1857, and in his paper on "Glenshira Sands," in the Quarterly Journal of Microscopical Science, 1854. In this last named paper, Prof. Gregory speaks of this same difficulty in knowing just where to place many of the new forms discovered, unless they are called varieties of species already established.

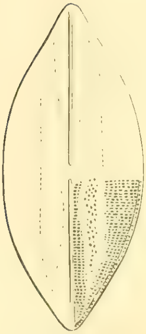
Mr. Charles G. Bush, to whom I am greatly indebted for assistance in examining this gathering, has found in it some very curious and new sponge spicules. When time will permit, I will give drawings of some of the most remarkable of them.

November 21, 1866.

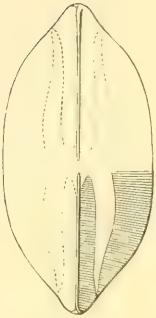
The President in the chair. Forty-seven members present.

Dr. C. T. Jackson, in referring to his remarks on a meteorite at the previous meeting, stated that he had recently received a paper from Daubrèe upon the subject.

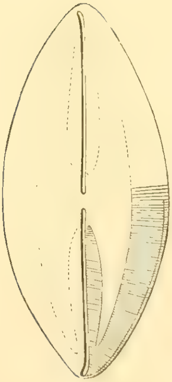
In this essay, the author referred to the non-occurrence of any meteorites in any sedimentary strata, attempting to account for it on one of two hypotheses. 1st, that meteoric phenomena may not have taken place when these sediments were at the surface of the earth, and 2d, that the matter then coursing in the heavens, constituted larger unexploded masses with oxydized crusts, so that if they had fallen, they would not be recognized as meteorites. Dr. Jackson, however, believed that too small a superficial area of the sedimentary



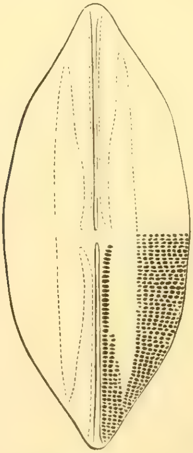
Navicula lyra *var.*



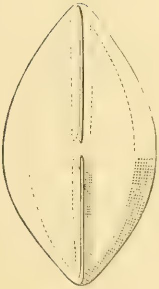
Navicula lyra. (typical form.)



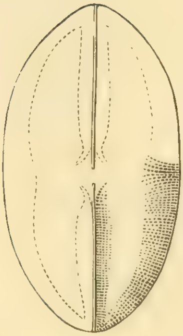
Navicula lyra *var.*



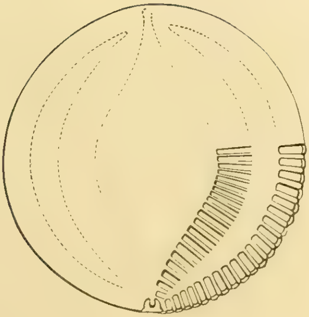
Navicula lyra *var.*



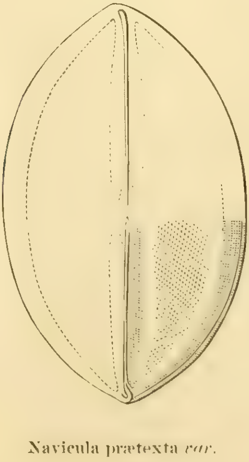
Navicula lyra *var.*



Navicula prætexta *var.*



Campylodiscus *sp.*



Navicula prætexta *var.*

strata had yet been explored, to expect much success in a search for them, remarking that the number of known specimens from the present surface of the earth was very small. The British Museum had only two hundred and twenty-five specimens, Vienna only one hundred and sixty-six, the Jardin des Plantes about the same, and the Amherst collection but two hundred; and that these all represented probably only about two hundred and fifty falls in all. Considering how much the surface of the earth had been worked over, with so few results, it is no wonder that in the rocks which had been far less disturbed, no meteorites had yet been found.

Mr. Edwin Bicknell read a letter giving a description of a sculptured stone found at Lake Utopia, New Brunswick.

This curious Indian relic, said the writer, is a basso-relievo, sculptured in red granite. It is of an oval shape, twenty-one inches long, eighteen inches wide, and one inch and a half thick. Although much worn and defaced by time and weather, it still retains evidence of having been executed by a bold and skilful hand. It was found in the month of November, 1863, at the foot of a precipice of red granite, on the western side of, and distant about a quarter of a mile from, the shores of Lake Utopia in Charlotte County, Province of New Brunswick. When shown to the Indians who frequent the neighborhood, they at once pronounced it to be the portrait of a chief, and remarked that it was probable his body was buried near the spot where the stone was found.

The tribe of Indians living at Lake Utopia, are the Passamaquoddies, descendants of the old Delaware stock, who for generations have made that locality their favorite haunt. The Indians are very skilful in their representations of the beaver, and other animals, and I have seen some very beautiful specimens sculptured in bas-relief on the bowls of pipes; they were anatomically correct in drawing, and would do credit to a professional artist. The Indians who have seen the stone, were completely at a loss to account for the style and quantity of the hair represented on the head, as from time immemorial it was customary for the Indians to shave or pluck out all the hair, with the exception of the scalp-lock, and although the shape of the head and features are decidedly Indian, there is an Egyptian character about it when viewed as a whole, which gives rise to curious ethnological speculations as to its origin, and by what people it was executed.

It was remarked that in the abundance of hair, which was cut square off behind, in the outline of the face from the forehead to the nose, and in the absence of massiveness of the lower jaw, there was nothing that was characteristic of the Indians. It appeared much like a rude portraiture of Washington.

Dr. Jeffries Wyman offered some considerations on the morphology of the leaves of the pitcher plant, and especially of our common Sarracenia.

He said that the former supposition that the pitcher was formed of the meeting together and union of the opposite edges of the leaf had been shown to be erroneous by the investigations of Dr. Hooker, who in studying the new leaves of seedlings, discovered that they first appeared in the shape of a cylinder, which was the rudiment of the blade of a leaf, and that soon a little depression appeared near the termination, which was homologous with the terminal gland at the end of some leaves. This depression increased till the pitcher was formed, so that instead of being a leaf, the pitcher was a hollowed midrib, or the prolongation of one which had become hollowed by a process of absorption or growth, or both.

Dr. Wyman had found that in our common Sarracenia, the new leaf first appears as a cylinder, showing no signs of pitcher or of opening; subsequently a little indentation was noticed on the front, and then above it, as seen in front, a little groove, which finally deepens till it splits, when the two sides open outwards, and form the lateral flaps or hood.

An interesting discussion followed these remarks relative to the power of absorption by plants.

Dr. B. G. Wilder inquired whether there was any absorption at the base of the leaf stalk in autumn, previous to the dropping of the leaves. Dr. Wyman said that he had found from microscopic sections of the base of the leaf stalk, at about this time, that while previously the cells were interlocked, as it were, they afterwards came into allignment upon either side of the plane where the stalk is subsequently broken, so that the leaf drops readily.

Mr. George B. Emerson spoke of the changes which occurred in the lower leaves of the cabbage plant, which he believed were not due to mere desiccation, but to an absorption by the plant for use in other parts in the completion of the head; the plant husbands its own resources. The same he believed to be true of the upper leaves of Indian corn.

On behalf of the Committee of Nomination appointed at the last meeting, Mr. R. C. Greenleaf brought in the name of Mr. Thomas T. Bouvé for the Vice Presidency, in place of the late Dr. A. A. Gould. Messrs. Brigham and Wilder were appointed Scrutineers, and the President announced, as the result of a vote, that Mr. T. T. Bouvé was unanimously elected.

The Letters which had been received since the last announcement, were read by the Secretary, as follows:—

From the American Antiquarian Society, Worcester, June 29th, and September 24th, 1866, the Lyceum of Natural History, New York, December 11th, 1865, and October 8th, 1866, K. mineralogische Gesellschaft zu St. Petersburg, December 22d, 1865, Naturforschende Gesellschaft in Bern, Die K. K. Zool. Botan. Gesellschaft in Wien, January, 1866, Société Impériale Géographique de Russie, St. Pétersbourg, August 6th, 1866, Bataafsch Genootschap der Prætondervindelijke Wijsbegeerte te Rotterdam, October 21st, 1865, Naturforschende Gesellschaft, Basel, September 15th, K. K. Centralanstalt für Meteorologie und Erdmagnetismus, October 5th, 1865, Deutsche geologische Gesellschaft, Berlin, November 4th, 1865, Director of the Museum at Bergen, Norway, December 16th, 1865, Linnean Society, London, July 20th, 1866, Chicago Academy of Sciences, September 25th, 1866, Librarian of the Public School Library, St. Louis, September 25, 1866, Literary and Historical Society, Quebec, October 13th, 1866, Librarian of the Public Library, Boston, October 19th, 1866, Portland Society of Natural History, November 6th, 1866, Smithsonian Institution, May 31st, 1865, December 18th, 1865, January 27th, 1866, April 10th, 1866, September 30th, 1866, Royal Society of London, August 27th, 1866, Society of Antiquaries, Scotland, September 1866, Mittelrheinischer geologischer Verein, Darmstadt, February 6th, 1866, Versammlung Deutscher Naturforscher und Aerzte, May 25th, 1866, Massachusetts Horticultural Society, November 8th, 1866, Connecticut Academy of Arts and Sciences, November 12th, 1866, acknowledging the receipt of the publications of the Society. From the Société d'Agriculture, Sciences et Arts de la Sarthe, Le Mans, March 23d, 1866, Oberhessische Gesellschaft für Natur- und Heilkunde, Giessen, September 10th, 1865, Asiatic Society, Calcutta, August 1st, 1865; L'Accademia d'Agricoltura, Commercio ed Arti di Verona, December 28th, 1865; Verein zur Beförderung des Gartenbaues, Berlin, March 30th, 1866, acknowledging the same, and presenting their various publications. From the Mineralogische Gesellschaft, St. Petersburg, December 20th, 1865; Verein für Erdkunde, Dresden, April 15th, 1866; Gelehrte Estnische Gesellschaft, Dorpat, March 5th, 1866; Kaiserliche Akademie der Wissenschaften, Wien, April 19th, 1866; R. Accademia di Scienze, Lettere ed Arti, Modena, February

18th, 1866; K. K. geographische Gesellschaft, Wien, March 6th, 1866; Universitas Carolina Lundensis, Lund, November, 1865; Geological Survey of India, Calcutta, December 1st, 1866; K. Preussische Akademie der Wissenschaften, Berlin, March 15th, 1866; Université Impériale de Kazan, December 31st, 1865; Asiatic Society of Bengal, Calcutta, May 21st, 1866; Wetterauische Gesellschaft für die gesammte Naturkunde, Hanau, March 12th, 1866; Akklimatisations- Verein, in Berlin, March 8th, 1866; Gesellschaft für Geschichte und Alterthumskunde zu Odessa, April 25th, 1866, presenting their various publications. From the Société Royale Linnéenne de Bruxelles, December 5th, 1865; Société d'Agriculture, etc., du Département de la Lozère, Mende, December 29th, 1865; Société des Sciences Naturelles de Groningue, January 4th, 1866; Institution Teylérienne, Haarlem, February 18th, 1866; Società Ligure di Storia Patria, Genova, December 1st, 1865; Schlesische Gesellschaft, Breslau, March 20th, 1866; Verein von Alterthumsfreunden im Rheinlande, Bonn, March 14th, 1866; Oberlausitzische Gesellschaft der Wissenschaften zu Görlitz, March 7th, 1866; K. Vetenskaps och Vitterhets Samhälle, Götheborg, March 20th, 1866; Gesellschaft Naturforchender Freunde zu Berlin, March 21st, 1866; Verein in Bregenz, April 10th, 1866; Mecklenburgischer patriotischer Verein, Rostock, March 13th, 1866; Gesellschaft für Natur- und Heilkunde, April 6th, 1866; Gesellschaft Finnischer Aerzte, Helsingfors, March 17th, 1866; Gesellschaft der Marino-Aerzte in Kronstadt, April 16th, 1866; Editor of the Tidsskrift, Copenhagen, June 10th, 1866; accepting the proposition of the Society to exchange publications. From the Naturhistorischer Verein der Preussischen Rheinlande und Westphalens, Bonn, March 1st, 1866; Société Linnéenne de Bordeaux, June 8th, 1866, acknowledging the receipt of the Society's publications, presenting their own, and replying to requests for complete sets of the latter. From the Accademia delle Scienze dell' Istituto di Bologna, April 2d, 1866; presenting its publications, and asking for certain numbers of the Journal and Proceedings of this Society. From the Verein der Freunde der Naturgeschichte in Mecklenburg, October 1st, 1865, acknowledging the receipt of the Society's publications, and asking for a missing volume of Proceedings, also regretting inability to complete the Society's set of its Archiv. From the Naturhistorisch-Medizinische Verein, Heidelberg, October 15th, 1865, acknowledging receipt of the Society's publications, and accepting the proposition for an exchange. From the Naturhistorische Gesellschaft, Hannover, regretting the inability to supply its Jahresbericht. From the Philosophische Facultät, Upsala, April 19th, 1866, regretting inability to exchange, as it issues no publications. From William H. Dall, Acting Director of Scientific Corps, Behring's Straits Telegraph Expedition, San Francisco, June 10th, 1866, communicating intelligence concerning the Expedition. From the Verein für Natur- und Heilkunde, Plauen, and the Gesellchaft der Seen Aerzte von Astrachan, March 23d, 1866, declining exchange as they issue no publications.

Rev. E. E. Hale, Dr. J. E. Walker and Mr. George J. Fisher, were elected Resident Members.

Section of Entomology. November 28, 1866.

The meeting was called to order by Mr. S. H. Scudder, and Mr. P. R. Uhler was chosen Chairman. Thirteen members of the Society were present.

The Section was formed by the adoption of the following rules:

1st. Only those members of the Society shall be considered members of this Section, who shall enroll themselves as such.

2d. Meetings of this Section shall be held in the Museum of the Society, on the fourth Wednesday of every month.

3d. The President of the Society shall be *ex officio* President, and the Recording Secretary *ex officio* Recording Secretary of the Section.

4th. The order of proceeding at the meetings shall be as follows:

1. Reading of record of preceding meeting.
2. Written communications.
3. Oral communications.
4. Donations.
5. Business.
6. Adjournment.

5th. The Records of this Section shall be entered in chronological order upon the book containing the records of the ordinary meetings of the Society.

6th. Such notices of each meeting of this Section as shall be judged by the Publishing Committee suitable for publication in the Proceedings and Memoirs of the Society shall be read by the Secretary at the next regular meeting of the Society.

7th. No change shall be made in the foregoing rules at any meeting of the Section at which less than five members shall be present.

Dr. A. S. Packard remarked upon the increasing distribution of the canker worm (*Anisopteryx vernata*). Up to within a recent time, it had not been supposed to extend farther north than Charles River, but recently, while on a visit in the neighborhood of the White Mountains of New Hampshire, he had discovered the males of both species of *Anisopteryx* flying in the evening in abundance, and had seen them on mountains from 2500 to 3000 feet high. Prof. A. Winchell of Michigan, had also found the *Anisopteryx pometaria* in that State.

Mr. P. R. Uhler inquired whether any of the members had ever witnessed any insects flying by means of their fore wings alone. He stated that he had seen upon the wing large numbers of our *Nemobius vittatus*, whose hind wings are nearly abortive, and that in the neighborhood of Baltimore he had witnessed, on two occasions, the males of *Horea sanguinipennis*, which have no rudiments of wings, and disproportionately heavy bodies, flying in early May by means of their elytra alone.

Mr. F. G. Sanborn stated that in digging recently on the banks of the Merrimac, for aboriginal relics, he had found from three to four feet below the surface, in light, sandy soil, living specimens of *Cotalpa lanigera*, *Cicindela generosa* and *repanda* and *Lachnosterna fusca*.

Mr. W. T. Brigham inquired how much was known about the longevity of the eggs of the *Phasmidæ*. He had made a collection of insects in the summer of 1863, and nearly two years afterwards had sealed it up; on opening it again, after a long absence, he discovered that an egg of *Diapher-*

omera femorata had hatched out, and the young insect lay dead at a short distance.

Mr. L. Trouvelot stated that the eggs of this insect almost invariably hatched only after the interval of two years, though sometimes in a single year when placed under favoring circumstances, and sometimes not for three years. He also stated that he had made some experiments upon the reparation of legs in this insect by breaking or cutting off the legs from the young insect, as it leaves the egg, and had discovered that in such cases a new leg appeared after the second moult, but it was very small and perfectly useless, while after the third moult, it was perfectly formed, and made use of by the insect, although diminutive in size; he had observed many specimens, and the intervals of moulting were always seventeen days.

December 5, 1866.

The President in the chair. Forty-three members present.

The Secretary read a paper entitled

A List of the Birds of St. Domingo, with Descriptions of some New Species or Varieties. By Henry Bryant, M. D.

Very little more is known at present of the birds inhabiting St. Domingo, than in the time of Buffon. The first considerable collection for many years, was made at the eastern or Spanish end of the Island, by Mr. Sallé, and a list of it published in the Proceedings of the Zoölogical Society of London, for 1857. Since that time, a collection was made near Port au Prince, by Mr. A. E. Younglove of Cleveland, Ohio, and presented to the Smithsonian Institution, and another in the neighborhood of Jeremie, by Mr. Uhler, which is the property of the Museum of Comparative Zoölogy at Cambridge. The following list contains all the birds of the three collections, as far as I have been able to identify them; those collected by Mr. Sallé being taken from his list published under the superintendence of Mr. Sclater. Though Jeremie is at the extreme west end of the island, I do not think it advisable to separate the birds collected at that locality from those collected at Port au Prince, which is also at the west end, but situated at the bottom of a deep bay, instead of at the end of a point. Those birds found at the eastern or Dominican end, are marked with an *, those from the western or Haytian, with a †.

Falco.

* † **Falco dominicensis.** I have marked this bird as from the eastern end, though the list of Mr. Sallé gives *F. sparverius;* there are four specimens in Mr. Younglove's collection, all of which are light in color, resembling more *sparverius* than *dominicensis* of Cuba. I am by no means certain, notwithstanding the extreme variation in the color of the Cuban birds, that a more extensive series of specimens will not show that *sparverius*, *dominicensis* and *sparveroides*, all belong to one species.

Strix (Athene).

* **Strix dominicensis.**

Tyrannus.

* † **Tyrannus griseus.** This, I presume, is the same as *T. matutinus* of Sallé.

* **Tyrannus intrepidus.** I am inclined to believe that there was a mistake in the identification of this bird, and that probably the two tyrants found by Mr. Sallé, were *griseus*, and either *caudifasciatus* or some other closely allied species, as such a bird is found in Cuba, Jamaica, and the Bahamas.

Tyrannula (Myiarchus).

† **Tyrannula stolida.** (Var., *dominicensis.*) Several specimens. This variety differs from *T. sagræ* and *T. bahamensis* in the distinct yellow of the abdomen, and from *T. stolida* in the very much broader rufous edging of the external web of the primaries.

No. 41,825. Length of wing, 83 ;§ of tail, 72½; of tarsi, 21 ; bill along culmer, 20. Above brownish-olive; head deep brown, with the edges of the feathers somewhat rufous, as are also those of the upper tail coverts; lores grayish, wings and tail dark brown, the tips of the greater and middle coverts whitish-ash, forming two bands, the anterior most distinct. The margin of the secondaries and tertiaries whitish, very broad and clear on the inner one. Margin of all the primaries bright ferruginous, occupying all the outer web at the base on the inner ones, and gradually disappearing near the sinuation. Tail with all but two middle feathers broadly margined on the inner webs with bright rufous, occupying rather more than half of the web of the outer feather, and two-thirds of the inner one. Beneath, throat, fore-neck and breast, light ashy; the latter shaded into the clear light yellow of the abdomen; bill and feet dark brownish-black.

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§ Measurements in millimetres.

(Blacicus.)

† **Tyrannula carribœa** (var., *hispaniolensis*). S. I. No. 42,-474. Length of wing, 72; of tail, 69; of tarsus, 13; of bill on ridge, 16. Above slightly ashy brown; head darker, and margin of feathers slightly ferruginous; wings and tail brown. First primary narrowly, and secondaries broadly margined with lighter. Margin scarcely, if at all, lighter than the rest of the feather; tail with outer margin weathered. Beneath pale grayish-cinereous, darker on the breast and shaded on the abdomen into a dirty, slightly fulvous, white; axillaries and under coverts pale tawny.

Setophaga.

* † **Setophaga ruticilla.**

Sylvicola (Dendrœca).

* † **Sylvicola palmarum.**
* † **Sylvicola canadensis.**
† **Sylvicola discolor.**
* **Sylvicola pensilis.**
* **Sylvicola coronata.**
† **Sylvicola tigrina.**

(Mniotilta.)

† **Sylvicola varia.**

Seiurus.

* † **Seiurus aurocapillus.**
* † **Seiurus noveboracensis.**

Todus.

* † **Todus dominicensis.** Among the alcoholic specimens obtained by Mr. Uhler, are some young ones that appear entirely destitute of the bright tints of the adult. I think from an examination of Lafresnaye's type specimen of *angustirostris* which was collected by Mr. Sallé, that they are merely narrow-billed specimens of this species, as Mr. Sallé also decided.

Tanagra (Euphonia).

* † **Tanagra musica.**

(Shizampelis.)

* † **Tanagra dominicensis.** Viellot has evidently confounded two birds in his description of *Tanagra multicolor.* § None of the varieties known to me have the back black, except *zena*, and his description is, I think, intended for that bird, and consequently *multicolor* must be considered as a synonym of *zena*. The four species or varieties of this subgenus present two patterns of coloration of the nuchal collar; in one which comprises *zena* and *portoricensis* this is well defined posteriorly as well as anteriorly; in the other, containing *pretrei* and *dominicensis*, the collar, though sharply defined by the black of the head, is shaded gradually into the olive of the back. There is a gradual gradation of the color of this collar, from the rich dark chesnut of *zena* through the bright ferruginous of *pretrei* and dark orange of *portoricensis* into the brilliant yellow of *dominicensis*. Three of the four have the rump and upper tail coverts of nearly the same color as the head; *portoricensis* has them of the same color as the back.

Arremon (Phœnicophilus).

* † **Arremon palmarum.**

Dulus.

* † **Dulus dominicus.**

Turdus (Mimocichla).

* † **Turdus ardosiaceus** Viell. I have taken it for granted that the bird called *Turdus plumbeus* by Mr. Sallé, is the same as the present one, though this is not absolutely certain, as there are two Thrushes of this subgenus in Cuba. On comparing the series from Port au Prince with that from Porto Rico, appreciable, though slight, differences can be detected, the bill and tarsi are brick red, instead of dull reddish-orange; the white tips of the tail feathers terminate obliquely toward the base, instead of being generally transverse; the bill is absolutely as well as relatively smaller; the wing is longer, the tail shorter; in neither of the two series is there any appearance of a division of the external face of the tarsus. Their habits are strictly those of a thrush, and why they are put with the mocking birds I can

not imagine. The smaller spotted thrushes come very near the genus *Sylvicola*, and deserve separation from the typical thrushes, infinitely more than the present group, which, however, on account of their curious pattern of coloration, may well be separated as a subgenus. The Porto Rico bird may be called *Turdus ardosiaceus*, var., *portoricensis*.

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§ "Ce Tanagra que j'ai trouvé dans les bois de St. Dominique et que j'ai pris en mer dans le *canal de Bahama.*" "Le mâle a le manteau d'un beau noir." Viellot Gallerie des Oiseaux. Vol. I. p. 101.

Mimus (Leucomimus).

* † **Mimus polyglottus** (var., *dominicus*). In the seven specimens from Port au Prince, the external tail feather is white in all. The second is white, with the external portion of external web dusky for about one fifth of the length, not quite reaching the tip. In one it occupies the whole width of outer web ; for half its length in this specimen there is also quite a large patch of dusky on the inner web. The third feather is white in one, with a little more than half of the external web dusky ; in another, there is also a small edging of dusky to the inner web ; in this, the feather is dusky with the tip white. This color running down the inner web gradually narrows to the anterior third, when it disappears ; the fourth feather has a small white spot at the end. It will be seen that the bird from the west end of the island is not to be compared with *orpheus* but *polyglottus*, if not considered as identical with the latter.

Vireo.

* † **Vireo calidris.** I presume the bird called *altiloquus* by Mr. Sallé to be the same as the specimen from the west end, which I have examined.

Fringilla (Phonipara).

* † **Fringilla olivacea.**

† **Fringilla zena** (var., *Marchii*). Several specimens from Port au Prince resemble very closely the Jamaican bird, called *Marchii* by Prof. Baird.

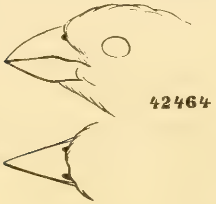
Loxia (Pyrrhulagra).

* † **Loxia violacea.** Specimens from Port au Prince are smaller than, though otherwise similar to, Jamaican and Bahaman birds.

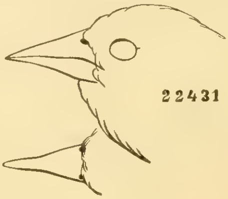
Chrysomitris (Loximitris).

† **Chrysomitris dominicensis** *n. sp.* One specimen from Port au Prince. S. I. No. 42,464. Length of dried skin, 105 ; of wing, 68 ; of tail, 44 ; bill from nostril, 44. Bill light brown color, with the tip dusky ; whole head and throat black ; back and scapulars olive, the centre of each feather dusky ; upper tail coverts bright olive-yel-

low; wings with the quills and coverts blackish brown; the smaller coverts with so much of the tips olive as to appear almost wholly of this color; the greater coverts, and all the quill feathers except the first, bordered externally with the same color, very narrowly on the primaries, and suddenly wider on the secondaries, but only on the posterior half, so that the closed wing presents a distinct blackish bar, running nearly across its centre; tail with the central feather, outer web of first and tips of all blackish-brown; the rest bright chrome-yellow. Beneath yellow, washed with olive on the flanks, and brightest on the crissum. This bird, though a typical *Chrysomitris* as far as color goes, in the shape of the bill is about half way between this genus and *Loxia*. The figure represents the lateral and vertical outline of the bill in comparison with the same part of *Chrysomitris notata.*



Chrysomitris dominicensis.



Chrysomitris notata.

Icterus.

*† **Icterus dominicensis.**

Quiscalus.

*† **Quiscalus ater** Baird. Two specimens from Jeremie have been identified with this bird by Mr. Cassin of Philadelphia, and are probably the same as *Q. barita* of Sallé's list. A smaller specimen has not yet been determined by Mr. Cassin. I am, however, inclined to believe it to be the female; and very likely both are identical, or nearly so, with *crassirostris* of Jamaica, Porto Rico and Cuba, in which case this latter name would sink into a synomyn.

Corvus.

* **Corvus leucognaphalus.**

* **Corvus jamaicensis.** I have not seen this bird of Mr. Sallé's list, but should not be surprised if it differed somewhat from the typical Jamaican bird, as by his account of its habits it is entirely unlike the latter.

Hirundo (Progne).

* **Hirundo dominicensis.**

(Kalochelidon.)

† **Hirundo euchrysea.** (Var., *dominicensis?*) One specimen ♂, from Port au Prince. The female Jamaican bird has the feathers of fore-neck and breast with rounded subterminal spots of metallic green. The present bird has the bill very much smaller than the Jamaican specimens, and there is no indication of the band of rich golden-red on the outer edge of the tertiaries and greater coverts.

Cypselus.

* **Cypselus cayanensis** Gmel.?

Trogon.

* **Trogon roseigaster.**

Alcedo (Ceryle).

* † **Alcedo alcyon.** Reichenbach has described this bird from St. Domingo as a species, as he did many other birds, without ever seeing them, in the hope that some one would discover that a difference existed, and he would get the credit of it. In the present case he was unfortunate.

Trochilus (Sporadinus).

* **Trochilus elegans.**

(Mellisuga.)

* † **Trochilus minimus.**

(Lampornis.)

* † **Trochilus aurulentus.**

Certhiola.

* † **Certhiola bananivora.**

Crotophaga.

† **Crotophaga ani.**

Saurothera.

* † **Saurothera dominicensis.**
* **Saurothera viellotii?**

Coccygus.

† **Coccygus minor.**

* **Coccygus dominicus**? Perhaps the common *C. minor*, which seems to be found everywhere in the West Indies.

Picus (Chloronerpes).

* **Picus passerinus.**

(Centurus).

* † **Picus striatus.**

Psittacus (Chrysotis).

* † **Psittacus Sallaei.** There was no specimen of this either in the collection of Mr. Younglove or Mr. Uhler; but while at Inagua, I saw a number that were brought over in small trading vessels from the west end of the island.

(Conurus).

* **Psittacus chloropterus.**

Picumnus.

* † **Picumnus micromegas.** This singular bird I presume to be the one identified as *Bucco cayanensis* by Mr. Sallé.

Columba.

* **Columba leucocephala.**
* **Columba corensis.**

(Leptophila.)

* **Columba** —— ?

(Geotrygon.)

* **Columba montana.** Possibly the same as the following bird.

† **Columba martinica.** Two specimens from Port au Prince.

(Zenadura.)

* † **Columba carolinensis.**

(Chamæpelia.)

* † **Columba passerina.**

Numida.

* Numida meleagris.

Ardea.

* Ardea leuce.
* Ardea candidissima.

(Butorides.)

* Ardea virescens.

Phœnicopterus.

* Phœnicopterus ruber.

Charadrius (Ægialitis).

* Charadrius vociferus.

Himantopus.

* Himantopus mexicanus.

Rallus.

* Rallus ——— ?

Aramus.

* Aramus giganteus.

Gallinula.

* Gallinula galeata.

Anas (Querquedula).

* Anas discors.

Podiceps.

* Podiceps dominicus.

Sula.

* Sula fusca.
† Sula dactylatra ?

Sterna (Anous).

† Sterna stolida. Abundant off the coast.

(Sterna.)

† **Sterna fuliginosa.**
† **Sterna regia.**
† **Sterna antillarum.**

Phaëton.

† **Phaëton flavirostris.**

Tachypetes.

† **Tachypetes aquilus.**

Procellaria.

† **Procellaria obscura.** The last eight birds were seen by myself off the coast, at a short distance from land, between St. Domingo and the island of Navassa.

Mr. W. T. Brigham mentioned that in crossing the Pacific in a ship with three hundred Chinese, returning from California to their native land, he took occasion to measure their height, weight, and size of chest; with the following results:

Mean weight of one hundred and fifty men . .	129.34 lbs.
" height " " " " . .	5.48 ft.
" size of chest " " " . .	33.33 in.

EXTREMES.

Weight	95 and 166 lbs.
Height	5 and 5.8 ft.
Chest	25 and 38 in.

One woman of average size measured

Weight	87.5 lbs.
Height	5 ft.
Chest	29 in.

The tallest man was a native of Shanghae; the others were strong active men, from the province of Quangtung, who had spent a few years in the mines of California. These were all adults, except two boys, whose measurements were:

Weight	134 and 98.5 lbs.
Height	5.48 and 5.5 ft.
Chest	34 and 32 in.

The people of the northern provinces are generally taller than those belonging to Kwongchowfoo (Canton). The superior strength of the Chinese over the people of India is well shown in the bearing of heavy burdens, two coolies carrying easily a sedan chair with its load, while four Bengalis stagger under a loaded palkee, which is but little heavier than its Chinese equivalent.

Mr. George Sceva stated that when in China, some ten or twelve years ago, he had made some examinations of the cramped feet of the women, by persuading one or two poor women in reduced circumstances, to allow him to remove the bandages which cover them, and are always retained through life.

It had been supposed that the custom of swathing belonged only to the aristocratic portion of the population, but it was really confined to a single caste, whether its members were rich or poor; the custom seemed to be dying out. It had been stated that the feet are compressed by means of wooden shoes; but these are not worn at all in China, the only ones he had seen there being regarded by the natives as a curiosity, though they frequently have wooden soles to their shoes. The compression is produced by bandages of a strong, inelastic silk, which, commencing at the toes, are wound tightly around the foot to a short ways above the ancle; in consequence of which the development of the calf of the leg is very slight. Besides these bandages a small pad, about an inch in thickness, is placed beneath the heel, forcing the bone of the heel upwards, so that a person apparently gains in height by standing on the metatarsal bones. The gait of the women under these circumstances, is much as if they were walking on stilts; and they are always supported by two servants, one upon either side. The feet of the Chinese women before compression are very small in proportion to their weight. Mr. Sceva had prepared the bones of two compressed feet, one by disarticulation, and the other with the ligaments in place, and they are now in one of the medical museums of this city.

In alluding to the remarkable way in which children followed the customs and occupations of their ancestors in China, Mr. Sceva remarked that families, which for many generations back had made it their business to carry chairs, showed unusual powers of endurance; two of them would carry a man for a mile on a dog-trot, and others were accustomed to carry great burdens of perhaps three hundred pounds weight with ease; this was done by suspending the divided burden upon the ends of a pole which rested on the shoulder but in endeavoring to ascertain their real strength, he found that these men could not sustain with the extended arms so much as he, being able to support only twenty-three to twenty-five pounds in this manner. The same was the case with many engaged in trade; they could support great weights, but their fingers could be turned back almost to the wrist, and they were very weak in the arms.

Dr. J. Wyman remarked that it was a Carib custom to place compressing bandages upon children six to eight years old, one around the ankle, and another just below the knee, which were retained through life. There seemed to be no loss of circulation, but the leg presented a curious appearance to the eye, as though it might easily be snapped apart by a slight exercise of physical force.

Mr. W. T. Brigham remarked that the Chinese had many other curious customs, one among which was to allow the finger nails to grow to an excessive length, which, however, they put to very dexterous use in sorting teas, by snapping the different qualities into separate piles.

Mr. Brigham also said that he had witnessed an attack by a cockroach upon a centipede, in which the roach jumped upon the back of a centipede, four or five inches long, and by successive bites between the upper and under plates, finally killed him, and then ate the internal parts.

Capt. Atwood addressed the Society upon the habits of our native species of *Gadidæ*.

The first mentioned by him was the Pollock (*Merlangus carbonarius*). In his Report on the Fishes of Massachusetts, Dr. Storer had mentioned two species of *Merlangus*, but in his last more extended paper had referred them to one. Capt. Atwood had seen only one, and this was considered the same as the European species, which was there called coal fish, whence came the specific name *carbonarius*. They appear about Cape Cod in schools in early May, frequently passing around Race Point so close to the shore as to be caught by the seine. They do not take to the hook freely, and are seldom seen in quantity along the coast in summer. In the autumn, however, about the 10th or 15th of October, they are caught in large numbers, when coming in to spawn. To effect this they seek rocky places as the cod does, but lay their eggs earlier than they; and it is only at this time that they take the hook freely. In the vicinity of Provincetown, the deposition of eggs takes place in November, but it occurs to the northward somewhat earlier. The Pollock is not strictly a ground fish, but it often rises close to the vessel. The liver yields much oil, and in this respect this fish is more productive than the cod.

The Hake (*Phycis americanus*) differs from the European representative of the same genus. It is a ground fish, found close to the bottom, and rarely comes to the surface. They are much more inclined to take the hook by night than by day; are found on muddy bottoms during the whole summer and autumn, along the coast of Maine and Massachusetts. They yield a large quantity of oil, which is used for the same purpose as that of the pollock and cod. The autumn finds them in the best condition, and, if prepared with care, they are a tolerably good table fish. Capt. Atwood had known them to grow to the size of forty pounds, but the average in summer is only five to ten pounds. There are two species of hake; for besides the one just mentioned, which at Provincetown has the name of the white hake, there is a smaller one called the squirrel hake, which mixes with the others around the shores and in the harbors, but is seldom found in the deeper waters. These have proportionately larger scales, and never weigh more than three or four pounds. Their caudal fin is also shorter, and a noticeable thing in dressing these fishes is that in the white hake the bones are softer than in any other of the *Gadidæ*, while the smaller species, or *Phycis filamentosus*, has bones as hard as those of the cod-fish.

Another species of the same family found in our waters is the cusk (*Bromius vulgaris*), which again is identical with the European species of the genus. They inhabit deep waters and rocky localities; not hard, smooth, rocky bottoms, but ledges, and the vicinity of large angular rocks. They are not so numerous as either of those previously mentioned, and at Cape Cod are quite rare. Capt. Atwood had seen a specimen or two to the eastward of, and near, Cape Cod, but they are more commonly found farther north. At a rocky spot on the eastern portion of the Middle Banks, between Cape Cod and Cape Ann, large numbers have been taken. A fisherman engaged in obtaining and curing these fish, had just told him that the firm with which he was connected had this year cured four hundred quintals of cusk; a larger quantity than Capt. Atwood had supposed had been taken along the whole coast. The flesh is white, and looks as well as good hake or cod; quite the reverse of the white hake, no fish of the family has such hard bones. There are but few localities where they have been found in any abundance; but off Wells' Bay in Maine, and on the same coast about Cape Porpoise, which is covered by sharp, rugged rocks, and also at Cashes' ledge, they are not infrequent.

In reply to a question, Capt. Atwood said that he had never seen any round or flesh worms in the pollock, though he had seen them frequently in the cod.

Dr. Michael Sars of Christiania, Norway, was elected an Honorary Member.

December 19, 1866.

The President in the chair. Forty members present.

Prof. J. D. Dana was elected an Honorary Member.

Dr. George L. Goodale of Portland, Me., was elected a Corresponding Member.

Dr. Charles H. Walker of Chelsea, Dr. C. P. Kemp of Boston, Mr. B. F. Davenport of Cambridge, and Mr. J. P. Whitney of Boston, were elected Resident Members.

Section of Entomology. December 26, 1866.

Mr. John Cummings, Jr., in the chair. Eight members present.

The following papers were presented: —

MATERIALS FOR A MONOGRAPH OF THE PHALÆNIDÆ OF NORTH AMERICA. BY A. S. PACKARD, JR., M. D.

In this paper the author describes over one hundred new species of *Phalænidæ*, with a synonymical list of all the species hitherto known, and occasional notes on their habits, and descriptions of larvæ. Though most of the forms are found in the United States, yet there are a few species from the West Indies and Central America.

The author is indebted for his material to the collections of this Society, the Entomological Society of Philadelphia and of Yale College, and of Messrs. A. R. Grote and James Angus of New York, F.

G. Sanborn, Frank Stratton and S. H. Scudder of Boston and Wm. Saunders of London, C. W.

SUPPLEMENT TO THE DESCRIPTIONS AND FIGURES OF THE ARANEIDES OF THE UNITED STATES. BY THE LATE NICHOLAS MARCELLUS HENTZ.

Some years since, Professor Hentz published in our Journal* an illustrated monograph of the Araneides of the United States. The original drawings, with many appended notes, came by this means into the possession of the Society. Finding that many of the drawings of parts, and a few notes upon the structure and habits of this rather neglected group had been omitted, I have carefully gleaned whatever seemed to be of any importance, for publication in the Society's Proceedings as an appendix to his Monograph.

A few of the original drawings engraved on the plates in our Journal are unfortunately missing; these are the ones figured on plates viii and xvii of Vol. IV. *Herpyllus dubius* is stated in the text to be figured on plate xxiv, fig. 24 of Vol. V, but no such figure is there, and no drawing of that species can be found. All the others are in the Society's possession.

It is worthy of remark in this connection, that the principal localities from which Professor Hentz obtained his Araneides were Northampton, Mass., College Hill, N. C., and Tuscaloosa, Ala., and that when "the United States" is given as the habitat of a species, it simply means that he had specimens from Massachusetts, and from one of the southern localities. S. H. SCUDDER.

Katadysas pumilus. The nails of the cheliceres cannot be opposed to each other, but may perhaps nearly join at tip, as they may in *Mygale*. Taken in January.

Dolomedes albineus. Fig. 73, eyes. The area of the eyes is black; thighs and breast all shining piceous underneath. Taken July 3.

Dolomedes lanceolatus. Specimens from Alabama are larger than those from New England.

Dolomedes sexpunctatus. Fig. 55, eyes. Legs immaculate and hairy, arranged 4, 2, 1, 3. Taken Feb. 28.

Micrommata carolinensis. The mandibles are very hairy at the top, 3-toothed; feet arranged 2, 1, 4, 3. Taken from April to December.

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* Boston Journal of Natural History, Vol. IV., pp. 54-7, 223-31, 386-96; pls. vii, viii, xvii-xix. Vol, V., pp. 189-202, 352-70, 443-79; pls. xvi, xvii, xxi-xxiv, xxx, xxxi. Vol. VI., pp. 18-35, 271-95; pls. iii, iv, ix, x. The numbers xvi, xxi-xxiv have unfortunately been used twice in numbering the plates of Vol. V.

Micrommata marmorata. Fig. 56, eyes; fig. 105, trophi. Prof. Hentz had formerly considered this to be the type of a new subgenus for which he gave the name of *Dapanus*, distinguished by having its second pair of legs longest, the eyes subequal, the hinder row curved posteriorly.

Micrommata pinicola. Beneath pale as above; covered with white curly hair besides the bristles; found March 22, wandering on the trunks of trees like *Thomisus.*

Micrommata serrata. Fig. 1, eyes. Taken July 26.

" **subinflata.** Taken February 20.

" **undata.** Fig. 98, trophi. This species differs from *M. carolinensis* in its anterior eyes, which are in a straight line and by its cephalothorax, which has one broad band; the abdomen has two hairy elevations anteriorly.

Oxyopes salticus. Fig. 90, trophi. It leaps with more force and vivacity than an *Attus.* Taken in North Carolina, in June.

Oxyopes scalaris. Fig. 120, the abdomen as it appears when empty. The figure in the Boston Journal of Natural History, Vol. V. plate xvii. fig. 4, represents it as it appears when full of eggs; feet arranged 1, 2, 4, 3. Taken in June.

Oxyopes viridans. Fig. 14, eyes; 14, *a*, specimen from North Carolina; 14, *b*, from Alabama; fig. 134, cocoon. The difference in the eyes of these specimens is only apparent and due to the quantity of hair which lies across them. Taken September 1.

Lyssomanes viridis. Fig. 91, trophi, wanting the palpus. Taken in April and June.

Attus audax. Northampton, Mass. Taken in May and July.

" **auratus.** Fig. 65, eyes; fig. 92, trophi.

" **canonicus.** Fig. 6, eyes. The jaws are very short.

" **capitatus.** Fig. 26, eyes. The mandibles have not so sharp an inner point as in *A. militaris*: the white band on the cephalothorax reaches neither the base nor the front; the yellowish white band on each side of the abdomen is blackish on the extreme sides; in the description given in the Boston Journal of Natural History, Vol. V., p. 200, it is stated that the second joint of the palpi is covered with white hairs; on the sheet containing the drawing it is stated that it is the first joint which is so characterized.

Attus castaneus. Fig. 36, eyes.

" **coronatus.** Fig. 82, eyes.

" **cristatus.** Fig. 112, lower surface of abdomen.

" **cyaneus.** Fig. 66, eyes. Taken in April, May, June, etc.

" **elegans.** Fig. 2, eyes. Taken in July.

" **falcarius.** Fig. 35, eyes. Taken August 6.

" **familiaris.** Fig. 74, eyes; fig. 99, trophi.

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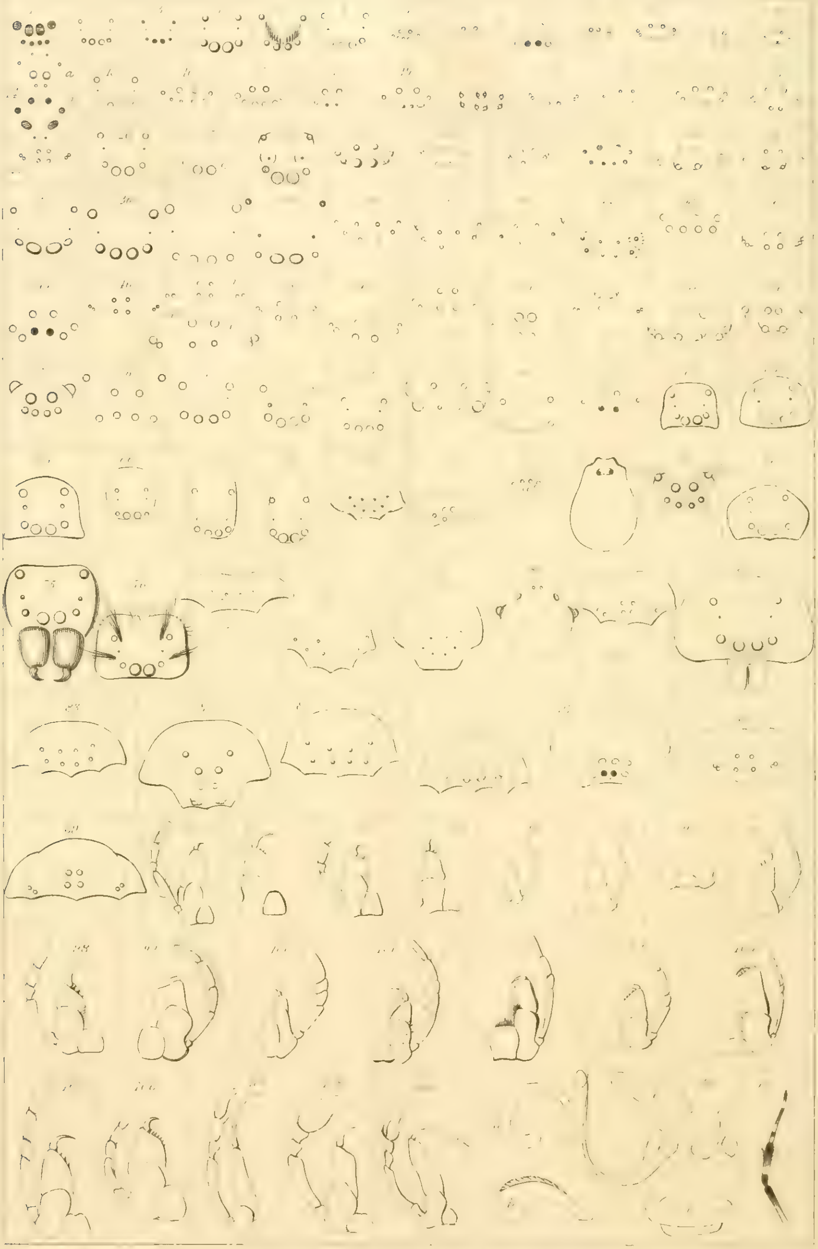

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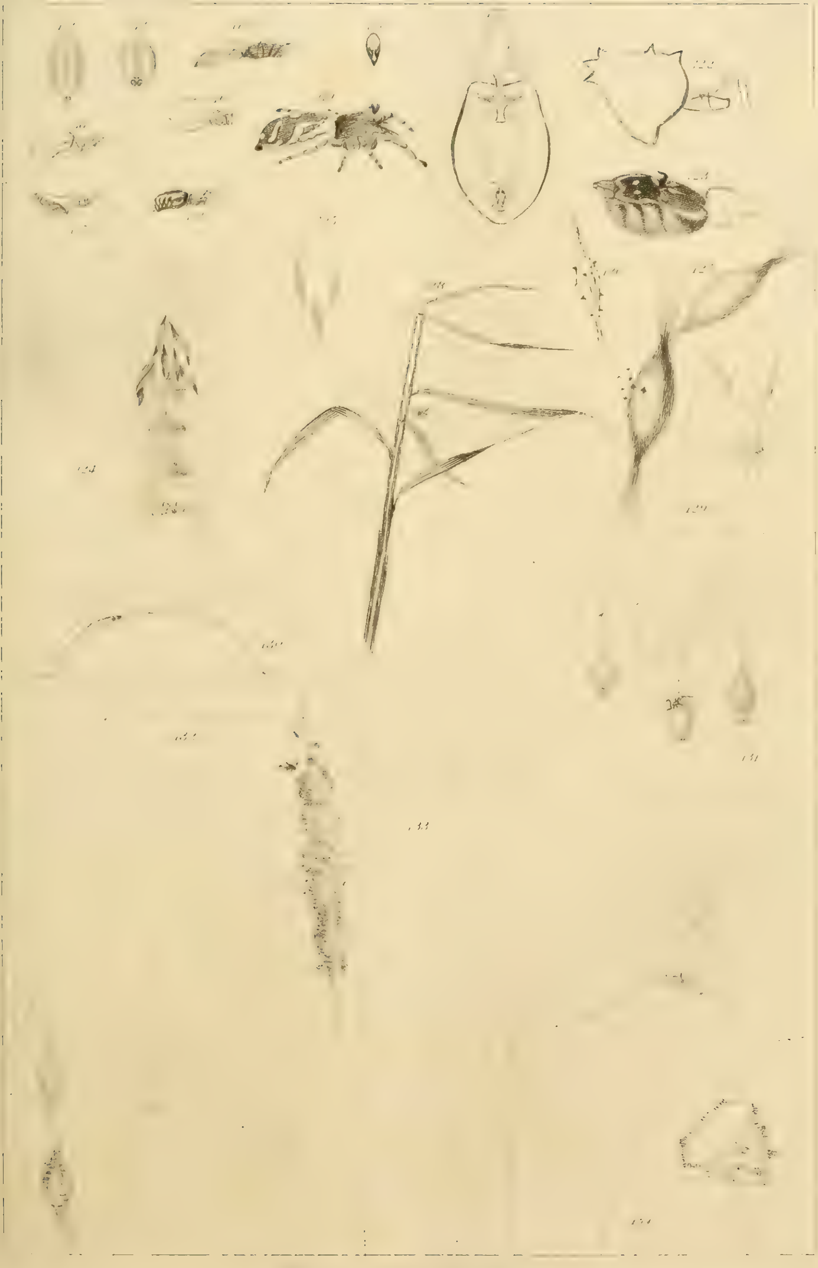
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Attus fasciolatus. Fig. 63, eyes.

" **gracilis.** Fig. 57, eyes; fig. 107, trophi.

" **hebes.** Fig. 3, eyes. Taken in June.

" **insolens.** Besides the second joint of the palpi and the feet, the knee of the first pair of legs is also varied with spots of white hairs.

Attus militaris. Taken in March, May and December. ♂ with the abdomen covered on the disc with golden hair or scales; the legs also with more scattered hairs of the same color.

Attus mitratus. Only males were found.

" **morigerus.** Taken October 17.

" **mystaceus.** Fig. 76, eyes; fig. 119, lateral view. Specimens taken in the fall were kept through the winter.

Attus niger. Fig. 4, eyes. Taken in July.

" **nubilus.** Fig. 27, eyes.

" **otiosus.** The legs are varied with rufous and black, with tufts of whitish hairs; the spots on the body vary a little in different specimens.

Attus podagrosus. Cheliceres darkish, but not green.

" **puerperus.** Fig. 28, eyes.

" **pulex.** A male one-third as large as the specimen figured in the Boston Journal of Natural History, Vol. V., pl. xxii, fig. 3, was taken May 29.

Attus retiarius. Legs arranged 4, 3, 1, 2. Taken in Alabama in May.

Attus roseus. Fig. 15, eyes.

" **rufus.** Fig. 37, eyes. Body covered with thick and long white hairs; cheliceres bright rufous, black at the apex, with a line of white hairs between them and the eyes. Alabama in May, July and August; in Carolina in August; and in Massachusetts in the collection of Prof. Peck, taken in July.

Attus sexpunctatus. Taken in July.

" **sinister.** Fig. 38, eyes.

" **superciliosus.** Fig. 5, eyes. On the antepenultimate joint of all the legs there is a black fillet on the anterior side, which is faintly continued on the preceding and following joints, and even on the thighs. Taken in June.

Attus sylvanus. Fig. 58, eyes; fig. 108, trophi.

" **tæniola.** Taken in May.

" **tripunctatus.** Fig. 75, eyes and extremities of cheliceres; fig. 106, trophi; very common in New England.

Attus viridipes. Fig. 64, eyes.

" **vittatus.** Cephalothorax with two rufous conic spots united at base; body pale beneath. Taken in May.

Epiblemum faustum. Fig. 59, eyes; fig. 109, trophi. Taken in June.

Synemosyna ephippiata. Fig. 68, eyes; fig. 114, lateral view.

Synemosyna formica. Taken in April, May and July.

" **noxiosa.** Taken in April and May.

" **picata.** Taken in June.

" **scorpionia.** Fig. 67, eyes. The ♂ was taken in November; the ♀ in February, a little larger than the ♂, and with the abdomen very slightly contracted.

Thomisus aleatorius. Fig. 39, eyes. Legs arranged 1, 2, $\overline{3, 4}$.

" **asperatus.** Fig. 41, eyes. Legs arranged $\overline{1, 2}$, $\overline{4, 3}$.

" **caudatus.** Fig. 60, eyes; fig. 100, trophi. Taken on January 25.

Thomisus celer. Fig. 78, eyes. Legs arranged $\overline{1, 2}$, $\overline{4, 3}$.

" **dubius.** Taken in April.

" **Duttonii.** Fig. 79, eyes.

" **fartus.** Fig. 69, eyes. Legs arranged $\overline{1, 2}$, $\overline{4, 3}$.

" **ferox.** Fig. 83, eyes. Legs arranged $\overline{1, 2}$, $\overline{3, 4}$. Taken in Massachusetts in October and March.

Thomisus parvulus. Fig. 42, eyes. The ♂ resembles the ♀, and is of the same size; the legs are green in the ♀ and pale in the ♂; legs arranged $\overline{2, 1}$, $\overline{4, 3}$. Taken in Carolina May 25.

Thomisus piger. Fig. 40, eyes. Legs arranged $\overline{1, 2}$, $\overline{4, 3}$. Taken in March.

Thomisus ? tenuis. Fig. 84, eyes; fig. 101, trophi. The two anterior eyes are placed on tubercles on the very margin; body beneath yellowish, downy. Taken June 8.

Thomisus vulgaris. Fig. 77, eyes. Legs arranged 2, 1, 3, 4. This spider withdraws into the chinks of fences, falls attached to a thread, and always moves off sideways.

Clubiona ? agrestis. Fig. 43, eyes.

" **? albens.** Fig. 32, eyes. Found travelling from one bush to another by means of a thread. Taken April 15.

Clubiona celer. Fig. 18, eyes. Legs arranged 4, 1, 2, 3.

" **fallens.** Fig. 17, eyes.

" **gracilis.** Fig. 8, eyes. Taken in June and July.

" **immatura.** Fig. 87, eyes.

" **inclusa.** Fig. 86, eyes. Legs arranged 1, 4, 2, 3. Taken in June.

Clubiona obesa. Fig. 16, eyes. Legs arranged 4, 2, 1, 3. Found hanging from trees by a thread. Taken at the end of June.

Clubiona pallens. Fig. 7, eyes. The second pair of legs is always sensibly longer than the first. Taken December 15.

Clubiona piscatoria. Fig. 29, eyes. The two external nipples of the abdomen are the longest; the body is of the same color beneath as above. Taken in April.

Clubiona ? saltabunda. Fig. 19, eyes. Prof. Hentz was in doubt whether this was a *Clubiona* or a *Tegenaria.*

Clubiona tranquilla. Fig. 85, eyes; fig. 102, trophi. Legs arranged 1, 2, 4, 3. Taken in Alabama and Carolina.

Herpyllus bilineatus. Of the six nipples, four were placed around the anus, and two formed a fork on both sides of the anus. Taken in May.

Herpyllus cruciger. Taken in July.

" **ecclesiasticus.** Legs arranged $4, \overline{1, 2, 3}$. This, and others placed in this genus, may belong to the genus *Diplotoxops* of Mr. Rafinesque, but as he makes the first pair of legs longest, and his generic description is incorrect in many respects—for instance in deriving a character from the palpi, which is as a rule nothing but a sexual distinction—his name has not been adopted.

Herpyllus longipalpus. Legs arranged $4, \overline{1, 2, 3}$.

" **marmoratus.** First, second and third pair of legs pale, thighs black with the tip white, third and fourth with bands of white scales. Taken in July.

Herpyllus ornatus. It is difficult to catch. Taken in July and August.

Herpyllus variegatus. The description of this in the Boston Journal of Natural History, Vol. V., p. 458, states that Southern specimens had the "external eyes" "placed nearer together"; it should have said the external eyes of the posterior line were advanced anteriorly; the specimens from the South were also smaller.

Herpyllus vespa. Taken in March.

Tegenaria medicinalis. Fig. 110, palpus of ♂ *a*, upper hook · *b*, lower hook and its membranous meatus above; *c*, middle sphenoidal piece; *d*, third hook corresponding to the fourth hook *i*; *e*, bristle which is usually curled between the first and second hook; *f*, base; *i*, fourth hook. The upper and lower hooks are parallel like two fingers; whilst the third and fourth are opposed to them; all forming a compound hook which must retain the female organ whilst the little bristle *e* stirs and conveys the sperma. That fluid flows from an orifice at the base of the lower hook, between it and the membrane situated on its upper part. The middle piece articulates with all the other parts except the base. The bristle and the third hook articulate together and with the base. The fourth hook seems to be a process of the upper hook. The lower hook articulates with the middle piece, and seems to have no motion of its own. The upper hook articulates with the lower hook and with the middle piece. Taken in North Carolina in March, and in Massachusetts in May.

Agelena plumbea. Fig. 45, eyes. Legs arranged 4, $\overline{1, 2}$, 3. Taken in March.

Cyllopodia cavata. Fig. 80, eyes.

Prodidomus rufus. Fig. 9, eyes. The three external eyes are oval shining white. Taken August 10th, in the recess of a large box in a dark cellar, hiding itself in holes.

Epeïra alba. Fig. 21, eyes. Legs arranged 1, 2, 4, 3. Taken in July.

Epeïra aureola. Legs arranged 1, 2, 4, 3.

" **bombycinaria.** Legs arranged 1, 2, 4, 3. Taken in August.

Epeïra cancer. The abdomen beneath is black, marked with numerous large dots; legs arranged 4, $\overline{1, 2}$, 3. Taken October 1st.

Epeïra caudata. Fig. 54, eyes; fig. 96, lip and mandible; fig. 116, lateral view of body; fig. 132, web and cocoons. Legs arranged 1, $\overline{2, 4}$, 3, or 1, 2, 4, 3.

Epeïra caroli. The body is piceous beneath; legs arranged 1, 2, 4, 3. Taken September 20.

Epeïra cornigera. Fig. 44, eyes. Legs arranged 1, 2, 4, 3.

" **directa.** A male was also found April 25, with black dots all over the legs, except on the thighs, and also with six black dots on each side of the abdomen; but evidently the same species; legs arranged 1, 2, 4, 3. It is nocturnal in its habits.

Epeïra displicata. Fig. 51, eyes. Legs arranged 1, 2, 4, 3.

" **domiciliorum.** Fig. 123, lateral and ventral view of the abdomen. Legs arranged 1, 2, 4, 3.

Epeïra fasciata. The presence of the eggs in the abdomen always creates a change in colors; legs arranged 1, 2, 4, 3.

Epeïra foliata. Fig. 50, eyes. Legs arranged 1, 2, 4, 3.

" **gibberosa.** Fig. 11, eyes.

" **hamata.** Fig. 49, eyes.

" **hebes.** Fig. 81, eyes. Legs arranged 1, 2, 4, 3.

" **heptagon.** Fig. 53, eyes; fig. 72, outline of cephalothorax. Body black or sometimes rufous; the legs are black, with pale rings; a male was found in Alabama with rufous hairy legs; legs arranged 1, 2, 4, 3. Taken in July.

Epeïra hortorum. Fig. 10, eyes. Legs arranged 1, 2, 4, 3.

" **infumata.** Fig. 52, eyes. Legs arranged 1, 2, 4, 3 Taken June 30.

Epeïra labyrinthea. Fig. 25, eyes; fig. 93, trophi, wanting the palpus; fig. 124, web and cocoons; fig. 133, web and tent. Legs arranged 1, 2, 4, 3. Very common in damp woods. Taken in September, October and December.

Epeïra maura. Legs arranged 1, 2, 4, 3.

Epeïra mitrata. Fig. 22, eyes. Sometimes there are no transverse bands on the abdomen, and then the black dots, about twenty in number, are more distinct.

Epeïra nivea. Fig. 48, eyes. Legs arranged 1, 2, 4, 3.

" **obesa.** Fig. 46, eyes. Legs arranged 1, 2, 4, 3.

" ? **pentagona.** Fig. 20, eyes. The first and second pairs of legs are much longer than the fourth.

Epeïra placida. Fig. 30, eyes. Legs arranged 1, 2, 4, 3.

" **pratensis.** Legs and cephalothorax immaculate, yellow; legs arranged 1, 2, 4, 3. Taken in July.

Epeïra prompta. Fig. 47, eyes. *a*, specimen from Massachusetts; *b*, specimen from Alabama; legs arranged 1, 2, 4, 3. Taken in Massachusetts in June.

Epeïra riparia. Fig. 121, abdomen beneath.

" **rubella.** Legs arranged 1, 2, 4, 3.

" **rubens.** A specimen was found corresponding in every respect except in having two obscure spots near the end of the abdomen. Taken in Alabama October 13th, on grass, beginning to throw threads from one blade to another; another was found in June, slightly larger than is indicated by the side lines in the Boston Journal of Natural History, Vol. V., pl. xxxi, fig. 18. Legs arranged 1, 2, 4, 3.

Epeïra rugosa. Fig. 122, lateral view of spider after impregnation. Legs arranged in some specimens 4, 1, 2, 3, in others 1, 2, 4, 3. Diurnal in its habits. Taken in July and August.

Epeïra sanguinalis. Fig. 62, eyes. Legs arranged 1, 2, 4, 3.

" **scutulata.** Legs arranged 1, 2, 4, 3.

" **septima.** The hair is yellow. Legs arranged 1, 2, 4, 3. It makes a very high web. Taken in September.

Epeïra spiculata. Fig. 31, eyes; fig. 94, trophi. Legs arranged 1, 2, 4, 3.

Epeïra stellata. Fig. 89, eyes. Legs arranged 1, 2, 4, 3.

" **sutrix.** Fig. 70, eyes; fig. 95, trophi. Legs arranged 1, 2, 4, 3.

Epeïra Thaddeus. A specimen was found in October, larger than the drawing given in the Boston Journal of Natural History, Vol. V., pl. xxxi, fig. 6, but the abdomen was nearly white instead of green.

Epeïra trifolium. Legs arranged 1, 2, 4, 3.

" **verrucosa.** Legs arranged 1, 2, 4, 3.

" **vulgaris.** Fig. 88, eyes; fig. 103, trophi. Legs arranged 1, 2, 4, 3.

Phillyra mammeata. Fig. 126, cocoon. The lateral eyes of the anterior row are difficult to be seen; the abdomen ends with a nipple-like tail, and is surrounded with six nipples; legs arranged 1, 4, 2, 3. A specimen was found in the clay nest of a Sphex. Taken in May, August, September and October.

Phillyra riparia. Fig. 61, eyes; fig. 111, fore leg. Legs arranged 1, 4, 2, 3. Taken in March and April.

Tetragnatha grallator. Taken in April and May, one specimen in a dry place on a tree far from any water.

Linyphia ? autumnalis. Fig. 71, eyes; fig. 97, trophi. Only seen late in the autumn.

Linyphia coccinea. Fig. 12, eyes. It forms a thread like *L. communis.* Taken in July.

Linyphia communis. Fig. 104, trophi; fig. 118, lateral view.

" **conferta.** Fig. 115, lateral view. A specimen had the legs of the right side arranged 1, $\overline{4, 2}$, 3; of the left 1, $\overline{2, 4}$, 3.

Linyphia costata. Fig. 24, eyes. Legs arranged 1, 2, 4, 3.

" **marmorata.** Fig. 23, eyes. Legs arranged 1, 2, 4, 3.

" **neophita.** Fig. 13, eyes. Legs arranged $\overline{1, \overline{4, 2}}$, 3. Taken in December.

Linyphia scripta. Fig. 130, web. Legs 1, 2, 4, 3.

Mimetus interfector. Fig. 33, eyes; fig. 127, cocoon. Legs arranged 1, 2, 4, 3.

Mimetus syllepsicus. Fig. 34, eyes. Legs arranged 1, 2, 4, 3. Taken in October.

Mimetus tuberosus. Legs arranged 1, 2, 4. 3.

Scydotes cameratus. The nails of the cheliceres are very minute; lip wide, lanceolate; maxillæ as in *Filistata;* last joint of palpi more slender than the rest. Taken from April to November.

Theridion boreale. The pale lines on the abdomen make an anchor shaped marking. Taken in Boston, Mass., and Alabama.

Theridion cruciatum. Legs arranged 1, 4, 2, 3, or 1, 2, 4, 3.

" **globosum.** Fig. 125, cocoons. The spider was found under bark or stones.

Theridion lineatum. A specimen was found in March with black legs and no white bands on the abdomen; others were found in July.

Theridion marmoratum. It has a whitish band on the anterior part of the abdomen over the back part of the cephalothorax.

Theridion morologum. Fig. 128, web.

" **oscitabundum.** It is of the same color beneath as above. Taken March 15.

Theridion ? pullulum. The spots on the abdomen are composed of little white dots surrounded by the brown marks.

Theridion roscidum. Fig. 129, web with cocoons.
" **sublatum.** Fig. 113, under surface of abdomen.
" **? trigonum.** Fig. 117, lateral view; fig. 131, cocoons. Abdomen beneath variegated with rufous.

Theridion verecundum. It always remains in the centre of its web, feet uppermost.

Mr. F. G. Sanborn exhibited an apple containing larvæ and pupæ of a dipterous insect, presumed to be *Molobrus mali* Fitch., the imago of which was unknown. The eggs were supposed to have been laid in fresh apples, in the holes made by the codling moth, *Carpocapsa pomonella*, whence the larvæ penetrate into all parts of the apple, working small cylindrical burrows about one-sixteenth of an inch in diameter, causing the decay of the adjacent parts. So much injury had been done in Wrentham, Mass., by this insect, that nine-tenths of the apple crop were destroyed; they invariably infested only those apples which had previously been attacked by the codling moth. In the apple exhibited, there were two pupæ about ready to transform, and Mr. Sanborn hoped soon to possess the parent insect.

Prof. A. E. Verrill stated that the Museum of Yale College had received some dipterous larvæ from Mono Lake in California, a body of water not only excessively salt, but also strongly alkaline; together with them had been found a species of *Artemia*, a genus of *Entomostraca* allied to *Branchipus*, which had hitherto been known only in the salt-pans of Europe. The dipterous larvæ were found in immense numbers, but the fly had not been reared. He had also received eggs, apparently of the same group of insects, from Salt Lake in Texas; the stick upon which they were laid was covered with salt crystals.

Mr. S. H. Scudder stated that Prof. Denton had seen dipterous larvæ in lakes in the Rocky Mountains, which were strongly impregnated with petroleum.

January 2, 1867.

The President in the chair. Forty-nine members present.

Mr. H. Mann exhibited a large panoramic photograph of the crater on the summit of Haleakala, the mountain of East Maui, Hawaiian Islands, and in explanation said:

The crater is now extinct, and has been so for a long time, so that the natives have only the most vague traditions concerning the residence there of *Pele*, the goddess of the volcano. She has now emigrated, according to their belief, to the island of Hawaii, where the volcanoes are still active.

This crater is situated on the summit of Haleakala, its rim, or what appears to be the mountainous boundary, being at the average elevation of ten thousand feet above the sea. Its depth is about two thousand feet, and the comparatively level plain which forms its floor is. therefore, at an elevation of eight thousand feet. The shape is that of an immense elbow bent at a little less than a right angle, the conical mountain seen near the middle of the photograph standing at the inside of the angle; the width of the crater from the western rim, from which the picture is taken, to the mountain at the angle, is four or five miles. The wall of mountains on the right is the southern rim of the crater, nearly ten miles long, and at its eastern extremity is an immense gap or break, leading down to the district of Hana. At the northern extremity of the western rim or wall is another gap, that overlooking the district of Koölau. The whole circumference of the crater is thirty or thirty-five miles, it being one of the largest in the world. From the outer angle of the elbow there is a steep sandy slope, nearly a mile long, affording the only access to the crater on that side for horses. From near the foot of this sandy slope there is a very large and distinct lava stream, looking as black and fresh as though it had flowed but a few days ago, and running down to the Koölau gap in a northerly direction. From near the same point stretches a line of cinder cones, probably of later date than the lava stream, (as cinder cones usually evince the dying out of volcanic action.) extending for several miles nearly across the widest part of the crater, with a general direction towards the eastern opening or gap. Sixteen of these cones can be counted from the western bank of the crater, and they vary in height from about three hundred to five hundred feet. They are exclusively composed of volcanic cinders, lying on as steep slopes as it is possible for them to maintain, as is very well perceived in walking up their sides, where the foot causes a continual slipping down of the cinders, and often, by depriving those above of their precarious support, brings down slides towards the climber. At the summit of each is a depression out of which the cinders were thrown during their formation. The two gaps, the eastern and northern, already spoken of, probably did not exist until towards the close of the period of activity of this volcano, or we should not see the distinct bedding of the mountains surrounding it, which could be produced only by the overflowing of the lava from vents higher than the present floor of the crater, or from a filling up and overflowing of the crater, as is so well known to have occurred in similar cases on the adjacent island of Hawaii.

Mr. Winwood Reade of England, who was present as a visitor, read to the Society a paper upon the habits of the Gorilla, the result of his personal investigation in the Gaboon region. He claimed from the accounts furnished him by Du Chaillu's guides, and others whom he examined critically in Africa, that the statements of Du Chaillu were not worthy of credence. He maintained, however, that other assertions of Du Chaillu which had been questioned by some, such as the cannibalism of the Fans, the mode of entrapping elephants, and the method of manufacture of musical instruments were without doubt correct.

Dr. Ogden presented a humerus of an Indian, dug from the banks of the Merrimac, in which the olecranon fossa was perforated, a peculiarity which Dr. Jackson had noticed in many Indian skeletons.

Dr. J. Wyman stated that this occurred not uncommonly in the white man; some years since he had examined all the humeri of Africans in the Jardin des Plantes, and found one-half with this perforation; he had also found it in the Gorilla.

Dr. J. B. S. Jackson said that he had examined six or seven Indian humeri from one of the islands in Boston harbor, and had found that all but one or two were perforated. In a Flathead which had died in this city, both humeri were perforated.

Dr. Jackson also stated that he had recently examined a human fœtus in which synosteosis of the parietal bones had begun, and in consequence of which the head had already assumed the deformity mentioned by Dr. J. Barnard Davis in connection with the premature closing of the sagittal suture.

The Secretary stated that the Council recommended a division of the Curatorship of Geology and Palæontology into its two branches.

On motion of Dr. Jackson, the proposition of the Council was accepted, and Drs. J. B. S. Jackson and J. C. White appointed a committee to nominate a candidate for the Curatorship of Geology, Mr. T. T. Bouvé retaining that of Palæontology.

The Committee reported the name of Mr. W. T. Brigham, and he was elected.

Prof. H. J. Clark of Agricultural College, Penn., was elected Corresponding Member.

Rev. Adams Ayer of Roxbury, Thomas Dwight, Jr., Prof. J. B. Henck, Rev. C. F. Knight, and Michael O'Shae of Boston, were elected Resident Members.

January 16, 1867.

The President in the chair. Thirty-six members present.

Mr. T. T. Bouvé read a letter from Mr. William Munroe, concerning the globular specimens of stone presented by him at a recent meeting, and presented a piece of American touchstone which he had received from a jeweller in New York.

Mr. C. T. Jackson said that the touchstone was still in use by the watchcase makers here; he once had occasion to test by better methods, the accuracy of their judgment. The stone used was a polished black Bazanite, and with it were employed twelve gold "keys" of known composition, and of graduated fineness; by means of a comparison between the mark left on the Bazanite by the gold under test, and that by one of the keys, and by the treatment of the same with nitric acid, they were able to estimate within a carat or two, the quality of the gold; the error, being frequently as much as two carats or two twenty-fourths, was considerable.

Mr. Winwood Reade gave an account of the manner in which the race of Fans, on the west coast of Africa, entrapped the wild elephant.

Mr. W. W. Bailey read on behalf of his brother, Prof. L. W. Bailey the following note on *Epigæa repens:*

On the 11th of May, 1866, a specimen of *Epigæa repens* was handed to me by one of my students who had collected it from waste, rocky ground back of the University at Fredericton, N. B. It exhibited some noticeable peculiarities, among which were a corolla *imperfectly* salver-form, the petals not thoroughly coherent into a tube, which was not hairy; the corolla apparently *not deciduous;* the stamens *reverted* into petals of the ordinary kind, more or less united; some of these showing a transition in having a filament-like base but no anthers. Pistils indistinct (reverted into petals?)

Similar specimens from the same locality have been given me on two successive years. Several clusters of blossoms were on the same vine, all possessing the peculiarities above alluded to.

Mr. Jeffries Wyman exhibited a number of malformed skulls to illustrate the remarks upon that subject, made at a previous meeting; by means of them he explained at length the theory of Dr. Davis of the mode in which the malformation of unusually elongated skulls is brought about; he also showed in a fœtal skull, brought to his notice by Dr. J. B. S. Jackson, the direct evidence of a closing of a portion of the sagittal suture.

The Secretary read the following letters which had been recently received: —

From the Philosophical Society of Glasgow, September 4th, 1866; Editor of the Correspondenzblatt für Sammler von Insekten, Regensburg; Zoölogisch-Mineralogischer Verein, Regensburg, September 16th, 1866; Smithsonian Institution, October 20th, 1866; Naturforschende Gesellschaft, Basle, September 23d, 1866; Massachusetts Institute of Technology, Boston, December 20th, 1866; Academie Royale des Sciences, etc., de Belgique, Bruxelles, August 1st and October 1st, 1866; Physikalisch-Medizinische Gesellschaft in Würzburg, September 7th, 1866; Naturhistorischer Verein, Lotos, Prag, October 6th, 1866; Naturforschende Gesellschaft des Osterlandes zu Altenburg, October 18th, 1866; K. K. Geologische Reichsanstalt, September 30, 1866; Institut Impérial de France, Paris, December 11th, 1866; acknowledging the receipt of the publications of the Society. From the Literary and Philosophical Society of Manchester, 1866; Naturwissenschaftlicher Verein, Lüneburg, October 1st, 1866; Royal Geographical Society, London, June, 1866; Naturforschende Gesellschaft, Halle, September 24th, 1866; Schlesische Gesellschaft für Vaterländische Cultur, September 20th, 1866; Naturwissenschaftliche Gesellschaft, Isis, Dresden, September 15th, 1866; Académie Royale des Sciences, Amsterdam, August 15th, 1866; Société Hollandaise des Sciences, Harlem; Société Entomologique des Pays-Bas, Leide, April 21st, 1866; Naturforschender Verein zu Riga, May 13th, 1866; Mannheimer Verein für Naturkunde, October, 1866; Société Entomologique de France, Paris, December 22d, 1866, presenting their publications. From the Académie Royale des Sciences, Amsterdam, November 23d, 1866; Gesellschaft zür Beförderung der gesammten Naturwissenschaften, in Marburg, September 28th, 1866; Verein für Vaterländische Naturkunde in Württemberg, Stuttgart, August 1st, 1866; Naturforschende Gesellschaft in Emden, 1866; Naturwissenschaftlicher Verein, Lüneburg, October 1st, 1866; acknowledging the receipt of the Society's publications, presenting their own, and regretting their inability to supply desiderata. From the K. Gesellschaft der Wissenschaften, Göttingen, October 15th, 1866, acknowledging the receipt of the Society's publications and accepting the proposition to exchange. From the K. K. Central-Anstalt für Meteorologie und Erdmagnetismus, Wien, October 2d, 1866, acknowledging the same and promising the new series of its Annals. From the Société Impériale d'Agriculture de Moscou, October 24th, 1866, accepting the proposition to exchange. From Prof. James D. Dana, New Haven, January 7th, 1867, acknowledging his election as Honorary Member.

Mr. James J. Putnam of Boston, was elected a Resident Member.

Section of Entomology. January 23, 1867.

Mr. P. R. Uhler in the chair. Fourteen members present.

Mr. F. G. Sanborn exhibited an extensive series of Noctuids, among which were the species of *Agrotis* described by

Harris. He called attention to the fact that *Agrotis clandestina* when at rest has the surface of the wings horizontal instead of arched one from the other, as in the other species.

Mr. P. R. Uhler stated that he had collected the naked chrysalids of *Agrotis telifera* at the base of maize plants in Maryland.

Mr. S. H. Scudder presented the results of an examination of a small collection of fossil insects obtained by Prof. William Denton in the Tertiary Beds of Green River, Colorado.*

The specimens were brought from two localities, called by Prof. Denton, Fossil Cañon and Chagrin Valley, lying about sixty miles apart. The rocks, in both cases, were the same; above were beds of brown sandstone, passing occasionally into conglomerate, alternating with thin beds of bluish and cream-colored shales, all dipping to the west at an angle of about 20°; they contained fossil wood of deciduous trees, fragments of large bones, most of which were solid, and turtles, perfectly preserved, and sometimes two feet in length. Prof. Denton considered this sandstone as probably of Miocene age. Beneath these rocks were beds of petroleum shale, a thousand feet thick, varying in tint from a light cream color to inky blackness, and filled with remains of insects and innumerable leaves of deciduous trees.

I have examined ninety specimens; many of the little slabs contain several species of insects, but the remains are often so fragmentary and imperfectly preserved, that it is impossible to identify them. Out of sixty-five different species, more than two-thirds belong to the *Diptera*; the others are mostly small *Coleoptera*, with a few *Homoptera*, *Hymenoptera*, *Lepidoptera* and *Physopoda*. Among the *Diptera*, *Mycetophilidæ* and *Tipulidæ* are prevailing types; the dipterous larvæ have not yet been determined, but they belong to groups otherwise unrepresented on these stones; some of them are apparently *Muscidæ*. The *Homoptera* are represented by genera allied to *Issus*, *Gypona* and *Delphax*. A species of *Myrmica*, one of *Formica*, and a third hymenopterous insect represent that suborder; a poorly preserved moth, apparently a Noctuid, is the only *Lepidopteron*, unless one of the larvæ prove to belong to some genus resembling *Limacodes*. Perhaps the *Physopod*, belonging to a group which has never before been found fossil, is of the greatest interest; remarkably well preserved specimens occur, from which the insect can be wholly restored. It differs so essentially from Heeger's illustrations of this group, that I propose for it a new generic name, *Palæothrips fossilis*.

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* See also these Proceedings, Vol. x., p. 305.

I am indebted to Baron Osten Sacken and Mr. Uhler for valuable assistance in determining many of these remains.

The specimens from the two localities differ so completely as to awaken the suspicion that the rocks of one locality may be older than those of the other. In both places, *Mycetophilidæ* and other *Diptera* are found, but in Fossil Cañon the variety and abundance are proportionately greater. The ants, the moth, the thrips, and nearly all the small *Coleoptera*, are restricted to Fossil Cañon, while the larvæ again come from Chagrin Valley.

Perhaps no general conclusion can be drawn from this small collection, particularly as there is a total absence of means of comparing it with fossil insects of a similar age in this country; yet while it does not agree in the aggregation of species with any of the insect beds of Europe, nor with those of the Amber fauna, there can be little doubt that it belongs to the Tertiary Epoch.

Mr. L. Trouvelot exhibited a specimen of *Saturnia cecropia*, in one primary of which the third costa was only partially developed, closing only one half the interspace which it generally spans. He also exhibited a specimen of *Bombyx Cynthia*, in which he had artificially caused one primary to expand to only half the extent to which the other wings reached, and in connection with it, presented the following paper: —

ON MONSTROSITIES OBSERVED IN WINGS OF LEPIDOPTEROUS INSECTS, AND HOW THEY MAY BE PRODUCED.

Very often *Lepidopterous* insects have been observed with one or more wings considerably smaller than the others; this imperfect development of the wings has been called a monstrosity. So far as my knowledge goes, I am not aware that any one has given an explanation of this phenomenon. I have observed how such monstrosities occur, noticed the cause, and have myself partially hindered the development of a wing of an individual of *Bombyx cynthia*.

Those who have observed *Lepidoptera*, know that the wings of these insects when emerging from the pupa are very minute, and that a fluid issues from the abdomen of the insect to help in the expansion of the wings. This fluid seems to be separately provided on each side of the body; as I have observed in some cases, where one pair of wings had grown faster than the other, that the side of the abdomen corresponding to the smaller wings was swollen very much more than the other.

When the expansion of the wings takes place, it sometimes happens that the wings swell up at one or several points. This swelling is caused by the fluid which issues from the abdomen of the insect for the purpose of developing the wings. This fluid accumulates between the two thin membranes covering the costæ, where obstruction in the vessel offers some resistance to its circulation, and so to the expansion of the wing; or a too dry atmosphere, by causing a rapid evaporation, impairs the necessary elasticity, and prevents their due development. Generally the pressure of the fluid from the abdomen is sufficient to overcome the difficulty, but sometimes the obstruction is so great, and to overcome it so much fluid is emitted, and with so great pressure, that the thin membrane of the wings can no longer resist the tension, and it bursts open where the fluids have accumulated, and they flow out. As these fluids are absolutely necessary for the expansion of the wings, their loss is the cause of the imperfect development, and when once they are lost, the expansion of the wing ceases entirely; nevertheless the other wings will continue to develop, the loss of the fluid of one wing having no influence whatever upon the growth of the others; probably each wing has a separated reservoir containing the fluids necessary for its development. This seems to be visible in the abdomen, as sometimes four distinct swellings are seen.

I have artificially produced this monstrosity in the wings. Observing a *Lepidopteron* just emerged from the pupa, I saw a large swelling on the discoidal cell on one of the wings, and pierced it with a needle; the fluid flowed from the puncture, and immediately the wing so wounded ceased to grow, while the three others continued their development to its full extent. The insect thus obtained was comparatively perfect, having only one wing smaller than the others, but well proportioned.

I have sometimes advanced the development of the wings of *Bombyx Polyphemus.* I selected for this purpose pupæ very far advanced in their transformation, as is shown by the looseness of the pupal skin, and by the color of the wings of the moth, which can be seen through it. I took carefully the pupal skin from around the moth and suspended the insect in the position that *Lepidoptera* take when emerging from the chrysalis. It is very rarely that the wings of such an insect are developed, though I have obtained some perfect specimens in this way; and in one instance the development of the wings took place only three days after the pupal skin had been removed. Success is more certain if the insect is put under a glass jar with a moistened sponge, and something for the insect to hang from; the dampness of the air in the jar will prevent the soft wings from drying too fast, and when the time arrives for the insect to accomplish its transformation, the fluid will be active. Such an insect has much analogy with a vertebrate born prematurely, the insect, like the quadruped, remaining almost motionless till the natural time for its birth arrives.

Mr. Sanborn remarked that it was frequently for the want of moisture that attempts to rear *Lepidoptera* had proved unsuccessful, the insect being unable to expand its wings in a heated dry room; he had avoided this difficulty by placing the insect just emerged, or about to come forth, beneath a bell glass, within which he had placed moistened pieces of bibulous paper.

February 6, 1867.

Vice President, Dr. C. T. Jackson, in the chair. Thirty-seven members present.

The following paper was read:

ON A FUNGOID PARASITE, OR CATERPILLAR FUNGUS, FROM THE PHILIPPINE ISLANDS. BY DR. SAMUEL KNEELAND.

Entomophytes, Fungoid Parasites on Insects, or Caterpillar Fungi have generally been described in works on Botany, the plant portion having attracted the most attention. Mr. G. R. Gray has specially described (1858) the insect portion of the Entomophytes, taking them up in the usual order of Entomological systems.

These parasitical plants or fungi infest insects of all orders, and in the larva, pupa, and imago states; some orders are, however, specially subject to them, from their habitats exposing them to become the basis for this vegetable growth.

The *Coleoptera*, many of which in all their stages live under stones, in damp earth, and among decaying vegetable and animal matters, are very liable to these attacks; and the fungus is seen protruding, single or multiple, from all parts of the grub or beetle. The aquatic forms appear to be free from the fungus. Many of their larvæ remain several years before undergoing metamorphosis, giving ample time and opportunity to receive the parasitic germs while under ground, during the tropical rainy season. There is no doubt that the growth begins internally, as specimens have been found in which the fungus was just bursting forth from some part of the body. The most usual place for the fungus to appear, is from the pectoral surface of the thoracic segments. The larvæ generally lie upon their side, so that the fungus usually appears from the lateral surfaces; they are usually found dead, and either decayed or dried up. One parasite is ordinarily all that is found on one larva; but two, three, or more, are occasionally found.

The *diurnal Lepidoptera* have not been found giving origin to these fungi, or even to moulds; but the *nocturnal Lepidoptera* are very much infested, both in the caterpillar and the perfect state. The parasitic mould or muscardine, which attacks and destroys great numbers of the silk-worm, belongs to this class of vegetable parasites.

Among *Orthoptera*, the mole-cricket (*Gryllotalpa*) has been found infested with a fungus parasite.

Among *Hymenoptera*, ants, bees, wasps and hornets are subject to similar growths.

Among the suctorial *Heteroptera* and *Homoptera*, (in the latter the *Cicadæ* especially), we find also these vegetable parasites.

Among the *Diptera*, the common and blue bottle flies are often seen adherent to windows and ceilings in the autumn, covered by a whitish mould or fungus, which seems to have burst out from between the segments of the abdomen, and between the joints of the legs; so rapid is the growth of this fungus, that when the insect is so far affected internally as to alight, it soon dies, and is attached by the fungoid filaments to the object on which it rested; it rapidly spreads in a few hours over the insect, and for some distance around it, as may often be noticed on the window panes.

Spiders are also affected in a similar way; and it might be interesting to ascertain if they are not thus affected from feeding upon flies infested with the fungus.

From the numerous examples now on record, it is certain that life is not extinct when the insect becomes the basis of the vegetable parasite. Most of the insects thus affected are vegetable feeders, and it is generally admitted that the spores or seeds of the fungus are swallowed by the insect with its food, and that the seeds do not become attached to the exterior of the body, and afterward penetrate to the interior. Mr. Gray is of opinion that the seeds are always introduced with the food; but other observers maintain that the seeds gain admission to the interior of the animal also by the tracheæ or breathing apparatus.

These seeds are so exceedingly minute as to appear like smoke in the air, and Fries has estimated above ten millions in a single plant; their minuteness, however, is not so wonderful as that each contains within itself the elements necessary for germination. Whether taken with the food from the soil, or from the air or soil by the breathing apparatus, the seeds begin to germinate, if the circumstances are suitable gradually increase, and fill the animal completely with the thallus; the insect retains its external form, though internally its fluids are dried up by the growth of the fungus; the plant then forces itself through the skin at various places, through the articulations, and even through the hard surface of the head.

It may be that the vegetable growth does not depend on its being nourished by the fluids of the insect; but that the insect, enfeebled by the heavy rains which fall periodically in the intertropical regions, receives the seed, which grows by the influence of external moisture, so that its thallus interferes *mechanically* with the functions of the insect, and finally destroys it, the vegetable growth predominating over the animal vital principle. It is possible that, if the insect be strong, as during the dry seasons, (these growths being usually noticed after heavy rains), it may eat the parasitic seed, which, from not finding a suitable nidus, may be voided in the usual way, time not being allowed for its germination; and in this way a vigorous larva might escape and go through all its metamorphoses, while an enfeebled larva would die.

These growths vary in length from a mere protuberance to an extent of ten inches, and in diameter from a fine hair to one-fourth of an inch.

Thus we see that the *Coleoptera*, *nocturnal Lepidoptera*, and *Hymenoptera*, from their habits of life, are most subject to form the bases of these parasitic fungi.

The specimen exhibited was found in the Philippine Islands, in January, 1866, on Mt. Mahahai, an extinct volcano, about fifty miles from the city of Manila; it was found about three thousand feet above the level of the sea, in a clearing in the forest which had been made a coffee plantation; the soil was black and rich, and quite moist from the daily heavy rains which prevail at this season of the year. The caterpillar when found, was dead, somewhat dry, though not decayed, and was lying on its side, the under surface resting in the moist rich soil. The attention of the gentleman who picked it up, and who gave it to me, was attracted by the peculiar color and aspect of the vegetable growth, which reminded him of the delicate roots of a hyacinth as seen growing in water; their size was about that of the hyacinth roots, but the color was more yellowish, and the structure more tough and elastic; the plant was living when found. The larva on which this parasite was growing is, according to Messrs. Osten Sacken and Scudder, that of a *Lamellicorn* beetle, of the family *Melolonthadæ*, and coming near *Melolontha*, or the May beetle or May bug. It has shrunk a little from immersion in alcohol.

I do not find in Mr. Gray's monograph, or elsewhere, any Asiatic

Coleoptera mentioned as having been found affected with any parasitic fungus.

Mr. C. J. Sprague has examined the fungus, and pronounced it to belong to the genus *Cordyceps*, one of the modern divisions of the old and extensive genus *Sphæria;* his observations on the specimen will be found below.

The fungus resembles much that figured on plate 3, fig. 3 of Mr. Gray's monograph, though the caterpillar in that instance belonged to the nocturnal *Lepidoptera* and not to the *Coleoptera*, and was of much smaller size. It must be very rare, as none of the natives or foreign residents had ever noticed anything of the kind before.

The body of this specimen, it will be noticed, appears filled with the fungus, and it has burst out in six different places, from the head to the tail, in filaments about one and a half inches long. The fungus is perfect, except that it had not gone on to fructification, and can not therefore be described as to its species. It is probably not a new species; but the insect and the habitat have not been, as far as I can ascertain, before indicated as the basis and locality of a fungus growth. The specimen I present to the Society. Mr. Sprague's remarks on the specimen are as follows:

One familiar with mycology will see in the fungus you send me only one of a vast number of immature growths, which not only puzzle the most learned in such matters, but are absolutely unrecognizable, until they reach fruition.

What is a species, what is a genus in mycology? You may comprehend the difficulty in answering this question when I say that, in all probability, not half of the recorded species of fungi, nor of the genera, even, are autonomous. Genera, which have stood in print for a century, are now found to be immature, non-developed forms of other genera totally dissimilar. One group of fungi produces fruit, or rather reproduces itself in seven distinct ways, and it was only when these protean forms had been laboriously traced into each other that the truth was discovered. *Isaria*, *Sycogale*, *Stilbum*, alluded to by Mr. Gray, are not autonomous plants. They are supposed to be peculiar, non-developed forms of ascoid fungi. I have no belief, myself, that the fungi infesting insects are at all peculiar to them. *Isaria* occurs on various things, as indeed do both the other genera. They all infest decaying matter. The genus *Sphæria* is wonderfully distributed. There are certainly peculiar forms which have only been found on insects. But I am not at all prepared to say that the *Isaria* may not develop into *Sphæria* under favorable circumstances. These things are so strange in their growth, that a certain form may for centuries never appear as other than a warty excrescence. never producing asci and spores, but propagating itself by mycelium, and then it may take on an ascoid growth quite dissimilar from its long non-developed appearance. Until you have *asci* and *spores*, you can never decide beyond any doubt as to the species of a fungus. You may even mistake as to genus. The mycelium accommodates itself to its matrix, and takes on, therefore, excessively varying forms.

The ascoid fungi infesting insects are all *Sphæria*, so far as I know. But *Sphæria* is now cut up into many new genera. Those forms which bear heads of asci on an elongated stroma, are now called *Cordyceps*. Several species are recorded. Your fungus is like *S. entomorhiza* in its habit; so much so that it has no peculiar characters to distinguish it. It has no perithecia, and consequently, no fruit. It has not reached a development which warrants a name. I should say that it has all the appearance of *Cordyceps*, but in the absence of all fructification, it is impossible to further name it. All I could give in its present state would be:

Cordyceps (?)

Stroma carnose, stipitate, color yellowish-white, about an inch in height, a sixteenth of an inch in diameter.

Parasitic on the larva of a lamellicorn beetle, sending up several undeveloped stipes having the general appearance of *C. entomorhiza.* Manila, Mr. G. M. Curtis.

I repeat that I have no belief in the exclusive attachment of certain fungi to certain insects. Fungi grow on everything organic. Some species have as yet been detected only on certain things; but this is so peculiar an exception, I place no reliance on the mere fact of an individual discovery of this sort. I mean that in a favorable locality, should you place the larvæ of all sorts of insects under the same atmospheric influence, I believe that the same fungus would grow from them all, in some of its many forms

If you look in our Natural History Society collection, you will find a fly in a pill box. From its back grow two little fungi, undeveloped, looking like two black pins; I doubt not that they are some species of *Cordyceps*. But in the absence of *perithecia* it is futile to attempt to name it; it may be *Stilbum;* but that is now thought to be immature *Sphæria*.

Mr. C. Stodder said that he had made an examination of this fungus, and remarked as follows:

As an opaque object, the surface shows longitudinal ridges and furrows.

I could not obtain sections perfect enough to show the internal structure satisfactorily. There is an epidermis of cells, containing coloring matter, rather dark yellowish-brown. The cells are about .001 inch in diameter, of irregular shape from mutual pressure, and much resemble the larger cells of the yeast fungus, as figured by Jabez Hogg, in the Proceedings of the Microscopical Society of London, January, 1866.

The interior substance is very dense and opaque; only very small fragments could be obtained transparent enough for observation. The only structural feature that could be made out was a linear arrangement of the material. When these small fragments were crushed on the glass, a few filaments of mycelium, and a few very small cells, some of them in moniliform chains of three to eight cells, were found. Also occasionally, groups of yet more minute cells, .0001 inch, probably spores, but nothing could be determined as to the position of mycelium, cells or spores, in the perfect plant.

It is highly probable that the long immersion of the fungus in alcohol has produced some change in its texture and density, such as to prevent the separation and distinction of the various parts of the organism, and that a satisfactory analysis can be made of it only on fresh specimens. It may be also that the most of the internal substance when dried naturally, would prove to be spores, like "puff balls," and other similar fungi.

Mr. Theodore Lyman exhibited models of fish ways which had recently been constructed on the Merrimack, under the direction of the State Commissioners appointed to investigate obstructions to the passage of fish in the larger rivers. He prefaced his remarks upon them by an account of the habits of the migratory fishes.

The shad (*Alosa præstabilis*) is one of the large species of herring that go each year, from the sea to fresh water, to deposit their spawn. The alewife (*Alosa tyrannus*) is a smaller species, having the same habit. The shad is notable, not only for its natural abundance, but for the wide ocean province which it inhabits; for, while Cape Cod makes, for many fishes, the boundary between the inhabitants of the northern and the southern waters, the shad seems equally to flourish in the latitude of Savannah and of the Gulf of St. Lawrence. With the first indications of spring weather, these fish, driven by the resistless instinct of propagation, approach in vast shoals the mouths of the great rivers. They begin to run up the Savannah as early as Christmas; the Chowan, Roanoke, and Potomac, in February; the Delaware in the middle of March; the Hudson, in early April; the Merrimack, late in April; and the Bay of Fundy in the middle of May. It is the theory of Professor Agassiz that they do not in one great army pass from south to north, parallel with the coast, turning in at the different rivers as they go; but that those inhabiting each river lie, during the winter season, in the deep water off its mouth, where they wait the return of the breeding time. The theory corresponds with the pretty well established fact, that this fish, as well as the salmon, *returns always to the river in which it was hatched.* Their manner of spawning is as follows. They work up a little circular sandbank, on which the spawns are lodged, and are guarded from that destruction to which they would be exposed from the small fish, did not the male constantly play round the deposit. This curious sentinel duty may account for the singular fact, that very few male shad are seined in our rivers, except in the night time. It may be that they pass the day in watching the eggs, at the bottom of the stream, after the manner of the stickleback. On the other hand, the females are mostly netted during the day; and they may, perhaps, deposit their spawn only in the night season, when they would lie below the sweep of the seine. The separation of males and females seems to be carried out even in the migrations; for, on the coast of North Carolina, the males arrive several days before their partners. The advance of the migration up a river is by no means a simultaneous movement, but progresses in a series of "runs." The first run is of fish smaller and not so numerous as those of the grand run which follows. These small fish are probably the progeny of the tributary streams, whose waters are warmer than those of the main river, but do not furnish so nourishing food for the fry hatched in them. As the first shoals enter the river, a few individuals, in whom the ova are probably already mature, make haste to the upper spawning grounds. The main body, however, proceeds leisurely, and while in tidal water, the fish even turn down stream at the flood. In pleasant weather they swim high, and sink to a lower stratum when the surface is ruffled by a cold east wind. After the great run, which may continue from ten days to three weeks, follows another scattered run; and it is a singular fact, that the spawn in the late fish is less developed than it was in the earlier ones. Once in their native river, there is little doubt that the companies proceed each to its own spawning ground; some in the tributaries, some in the main stream, and some, even, in the lakes that communicate with it. Thus it is plain that the operation of spawning cannot be simultaneous for the whole of a river; on the contrary, it extends over several weeks, some fish being ready to deposit on their first advent, while the eggs of others are comparatively immature. The time of the return of the parent fish to the sea is not so accurately known as could be wished; but, after spawning in May and June, they doubtless pass down gradually from the middle of June to the first of August; after which there are still to be found stragglers during September, in the Merrimack, and late in October in the Connecticut. It has been ascertained definitely, that the young fish do not remain in the river after the end of September, when they have attained a length of about four inches, and resemble the adult in form, but have not yet the lateral line of dark spots behind the head, which may be seen in the adult after the scales are removed. The young taken in August exhibit an extraordinary difference in size, showing that the spawn is deposited at different times by different shoals of fish, and that, therefore, the broods of young will be more or less grown according to their ages. The length of life in the shad is a disputed point. Dr. Howell thinks they get their full growth in a single year. Valenciennes inclines to the belief, that, in the European species, many individuals die after spawning, at the end of their first year. On the other hand, the investigations of Mr. U. S. Treat of Eastport, show that the alewife gets its full growth only at the end of four years; and analogy might point to the belief that the closely allied shad had the same rate of development. Certain it is that there is a great difference in size among fish caught in the same river. In the Merrimack they range from three to eight pounds. In the Maine rivers they attain to ten pounds, and in the Delaware they are caught as large as twelve pounds. These differences, however, may as well be due to food and locality as to age.

The salmon (*Salmo salar*) is common to the northern waters both of America and of Europe. In its habit of spawning in fresh water it resembles the shad, but there the likeness ends. It seeks the coldest, purest and most rapid streams that are to be found at the sources of the river it frequents. It comes from the sea nearly with the shad, or a little later, and is then in high condition. After its entrance into fresh water, it steadily falls away; indeed the generally received opinion is, that it eats little or nothing during its sojourn in the river; and its habit of rising at, and seizing, an artificial fly, is generally attributed to play or to irritation. The spawning season does not occur till autumn, or till winter, according to the country. In New Brunswick this season is from the first of October till early in November; in the Merrimack it was in October, and in the Connecticut, early in September. It should be observed, however, that rivers of the same region may vary by some weeks in their spawning season, owing to their relative position and the temperature of their waters.

Seeking a gravelly spot, in a pure, running stream, the female excavates with her head a series of shallow holes, in each of which she deposits a portion of spawn, which is impregnated by the male and covered with gravel partly by the current of the stream, and partly by the tails of the fish. The parent fish soon after go down to the sea. They are then in a state of extreme emaciation, and are known in England as "kelts." After ninety to one hundred and twenty days, according to the temperature of the water, the embryo is hatched, but still has a little bag, the yolk-sack, hanging to its belly. At the end of thirty days the yolk-sack is absorbed, and we have a perfect minnow, about an inch long, with a trout-like form, and having its sides barred like *Perca flavescens*. In this state it is known as a "Parr," and was long considered as a separate species. For a whole year the parr swims in the brooks that gave it birth; but, as its second spring approaches, a great exterior change comes over it. Bright, silvery scales invest its sides, and cover the bars that formerly distinguished it. In this new dress the parr becomes a "Smolt," and is a miniature salmon, about four inches long. But this change does not simultaneously affect *all* the brood, a part of which continue in the parr state another year and remain in the fresh water; while the more precocious ones make for the sea in spring or early summer. In New Brunswick some smolts go down as late as August, while in England their time is May. They return in September, but now wonderfully grown; little fish, that left the river weighing from four ounces to eight ounces, reappear, after some ninety days, increased to two pounds or five pounds. The travelled smolt now becomes a "Grilse," and in late autumn or early winter, according to the country, returns once more to the sea, and again comes back to its river the following spring. At three years old — that is, the third spring after its birth — it is a "Salmon." The mature fish has the tail less forked than when a grilse, and is of a more robust form. At this age the female carries spawn for the first time; but the male, while yet a parr, is fecund at eighteen months, and frequently pairs with a full grown female salmon. These details of growth are necessarily introduced to show at what seasons the fish pass up and down the river; for, at these times, a *free passage* must be provided for them over all obstructions. The weight of full grown salmon differs much in different streams. The average of the old fish in the Merrimack was about fifteen pounds; in the Connecticut they seem to have been larger, getting sometimes to thirty-five, or even forty pounds, though not so "large and rich" as those of the St. Lawrence. It sometimes happens that, by a convulsion of nature, or a like accident, salmon are cut off from their return to the sea. They are then called "land-locked," and continue to breed, though they decrease in size. Those taken in the St. Croix River weigh from one to four pounds; but in southern Sweden they occasionally attain to twenty pounds, and average six or seven pounds. That the salmon lives to a considerable age is certain, from actual experiment. From actual experiment, too, we know that the progeny of a river always return to the same from the sea, and to no other.

The chief cause of the decrease of migratory fish has been *the building of impassable dams.* To obviate this difficulty, the construction of fish-ways has become necessary; and we find that there are a dozen conditions which a fish-way, be it small or great, must fulfil, to wit: that a good channel lead up to its lower end; that the lower end be so placed and arranged that fish easily find it; that the head be so placed as to be easily found when the fish again pass *down* the river; that the lower end, and the whole course, be wide enough; that the ascent be not too steep; that there be a sufficient sheet of water falling down it; that the supply of water be properly regulated at the head; that it be protected from destruction by falling ice, by freezing up, by floating timber, and by freshets; that the water above and below be practically pure; that it be protected from poachers; that it be not placed near machinery that might scare away the fish; that no fishing be allowed within four hundred yards of its upper and its lower end; and finally, that it be kept open at all times when the migratory fish are passing *up* the river, or are returning *down* the river.

Fish-ways may be made in two modes: the *pass*, which is simply a sloping trough, or the *stair*, which is a series of steps, whereof each is a water-tank. In the first case, the fish rush up the sloping trough; in the second, they jump from step to step, aided by the flowing sheet of water, which makes a series of little falls in its descent. The pass is more simple, cheaper, and less likely to get out of order; but the stair gives better chances to the fish to rest in their ascent, and is, therefore, more fitted for high dams, and for fish of less activity than the salmon; for example, the shad. Several modifications may be introduced in the construction of both. Where a pass is of considerable length, it is necessary to nail to its floor, cross-cleats, or bulkheads, which run from and at right angles to the sides of the trough, about two-thirds across it, leaving the remaining third open. These bulkheads are arranged alternately, so that the open space comes first on one side of the trough and then on the other; thus the water, running down, strikes the bulkheads, and is constrained to pursue a spiral course through the alternating openings. In this way the speed of the water is checked, its course made longer and less steep, and a series of eddies is formed, below the bulkheads, wherein the fish may rest. Other modifications will suggest themselves; an additional set of bulkheads may be inserted, at right angles to the first, in such a way that the water must run first forward; then to the right; then forward; then to the left; then forward again, and so on. In the stair, the first modification of a simple line of tanks set step-fashion, and pouring from one into the next lower, is to make one-half of the outer lip of each tank *lower* than the other half, so that the water will flow only over the lower portion; the *opposite* half of the next tank is cut out in the same manner, and the range of steps thus forms an alternating cascade, having advantages similar to those of the bulkhead arrangement in the pass. Where it is desirable to make the stair short, it may, so to speak, be doubled on itself; that is, two lines of tanks may be joined side by side: the water from tank No. 1 would fall to the right into No. 2; then forward into No. 3; then to the left into No. 4; and so on, each tank lower than its predecessor. The channel, or the particular current of the river, that leads to the foot of the pass, must be deep enough, and not too violent or too much obstructed. The regulation of the water at the upper end is very important; otherwise, in a freshet, the fish-way would be so flooded that the fish could not easily get up, and the structure itself might be carried away. The regulation may be made by a simple contrivance of movable bulkheads, or cross-boards. The head of the pass may be protected from floating ice by its position, and, if need be, by a boom. The tanks of a stair should be built with slanting sides, so that they may not be burst by ice. It has been shown that polluted water, discharged into a river, loses, almost immediately, its chief deleterious elements. This suggests an easy and cheap method of preventing the poisoning of the main body of a large river by the discharge from race-ways. Let there be erected in the river, opposite each race way, and far enough from it to avoid backwater against the wheels, a close plank screen, running parallel to the river bank, and at right angles to the race way. This screen should be of a height proportionate to the depth of the water; and it should start just above the race-way, and extend down stream forty or fifty feet. When the foul water rushes from the mill, it will come in contact with the screen, and will be deflected in a direction parallel with the river bank, and nearly coincident with the river current. Prevented, in this way, from flowing into the middle of the river, it will, after a run of a few hundred feet, probably, become pure enough to mingle with the rest of the water.

Finally, there comes the last essential of a fish-way, namely, that it should be *open* for the fish, both *coming* and *returning*. From about the 25th of April till the 15th of July, shad are either running up the two rivers to spawn, or are returning after the performance of that function; while, in the first part of this period, salmon also would be making their way to the head-waters, and smolts would be passing down to the sea. From about the 20th of August to September 15th, the young shad are going down to the sea, and the grilse would be coming up. From that time to the middle of October, on the Connecticut; or from October 15th to November 15th, on the Merrimack, the old salmon would be going down to the ocean. Therefore, if these rivers were restocked, fish-ways would have to be open on the Connecticut from the last part of April to the middle of October, except from the middle of July to the last part of August; and, on the Merrimack from the last part of April to the middle of November, except from July 15th to August 20th, and from September 15th to October 15th.

Dr. Jackson stated that when a boy in Plymouth, Mass., the alewife was very abundant, and was caught in vast numbers in the town brook which was then open to Billington Sea. They were also preyed upon by the cod on their return to the ocean, and large numbers of cod were taken even at the wharves. Since the alewife has been shut out of the streams by the erection of dams, the cod, too, has almost disappeared from Massachusetts Bay, and thus two fisheries are almost wholly abandoned.

The letters which had been received since the last announcement were read by the Secretary.

From the Philosophical and Literary Society of Leeds, September 11th, 1866, acknowledging the receipt of the Society's publications. From the Reale Istituto Lombardo di Scienze e Lettere, Milan, November 25th, 1865, acknowledging the same, and asking for such as were necessary to complete the series in its possession. From the Geological and Polytechnic Society of the West Riding of Yorkshire, October 17th, 1866, acknowledging the same, presenting Reports, and regretting inability to supply all the numbers asked for. From the Académie des Sciences et Lettres de Montpellier, August 30th, 1866, acknowledging the same, and presenting its own publications. From the Geological Society of Glasgow, November 19th, 1866, presenting its publications and desiring an exchange. From William H. Dall, Chief of the Scientific corps of the Western Union Telegraph Company, Fort St. Michael's, Russian America, September 26th, 1866, announcing the death of Major Robert Kennicott, of that Corps, a Corresponding Member of this Society.

The Treasurer announced a bequest to the Society by the late Miss Sarah P. Pratt of Boston, and read the following extract from her will: —

THIRD ARTICLE: "My collection of shells, and the cabinets and cases in which they are kept, Kiener's work on Conchology, and all my other works on Conchology or shells (with the exception of the

Boston Journal of Natural History herein before bequeathed), I give to the Boston Society of Natural History; I also give to said Boston Society of Natural History in trust the sum of ten thousand dollars to be invested as a permanent fund, the income of which, after deducting all expenses and charges incurred in the management and execution of the trust, shall be forever applied to the purchase of recent shells, of all needful cabinets and cases, and of works relating to shells, or the science of Conchology, and to the expenses of maintaining and preserving the collection of shells, the cabinets, cases and books, in good order and useful condition, any balance of income not expended for the purposes aforesaid, to be added to the principal fund."

Section of Microscopy. February 13, 1867.

The Curator in the chair. Fourteen members present.

The following paper was presented:

On a Recent Gathering of Diatomaceous Mud from Pleasant Beach, Cohasset. By Charles Stodder.

While on a visit to Pleasant Beach, Cohasset, in the summer of 1866, I was strongly affected by an exceedingly offensive smell, which pervaded the vicinity of Kimball's hotel, and was impressed with the fact that the peculiar quality of the odor was the same as comes from a bottle of decaying marine diatoms. The smell is well known to all visitors and residents of that favorite watering place. I easily found the locality where it originated, the marsh directly in the rear of the Minot House. This marsh is separated from the bay merely by the strip of sand and pebble beach, on which the Minot House stands. It is covered with water at spring tides. The tide water has access to the marsh by a channel about a mile distant from the Minot House, and must have a course of nearly two miles to reach the place.

A friend procured for me a bottle of mud from the marsh, taken at high-water mark, which proved to be composed almost entirely of animal and vegetable matter, alive and dead. The origin of the smell was now fully explained by the decomposition of the organic matter. The animals were mostly infusoria, and the vegetables, roots and fibres of grasses, and diatoms. The only inorganic material was a few grains of sand, evidently carried into the marsh from the beach by the wind.

From the peculiarities of the place there is no tidal current whatever, the water only rising and falling with the tide. Some materials or organisms may be blown on the surface of the water, but other than that, all the organisms found may be considered as being in their native habitat. Now we have in this locality a deposit of unknown depth, made up essentially of organic matter, more or less decomposed. The silicious shells of the Diatomaceæ, being indestructible, are found abundantly in the superficial mud, and may be expected to bear a still larger proportion to the whole at greater depths. The living diatoms were very numerous, but all being mixed together there could be no attempt to specify which were living and which were dead.

The variety of diatoms found is very great. The following species have been identified, not, however, in all cases as being exactly like the typical forms, but so nearly as to be within the admitted limits of specific variation.

Pleurosigma inflatum *Shadb.*
" elongatum.
" Balticum.
" fasciola.
" æstuarii.
Stauroneis salina.
" aspera.
Navicula punctulata.
" lyra—elliptic and apiculate.
" elegans.
" Smithii.
" didyma, several varieties.
" granulata *Bail.*
" libellus *Greg.*
" quadrifasciata.
" varians *Greg.*
" gastrum.
" iridis.
" kergulensis.
" bombus.
" nebulosa.
" (Pinnularia) perigrina.
" " lata.
Amphora membranacea.
" salina.
" robusta.

Nitzschia sigmoidea.
" sigma.
" scalaris.
" plana.
Achnanthes brevipes.
Rhabdonema arcuatum.
Fragillaria capucina.
Triblionella punctata.
Auliscus americanus.
Himantidium parallelum.
Amphiprora complexa *Greg.*
" maxima.
" vitrea.
Cocconeis placentula.
" scutellum.
Raphoneis ——— ?
Cymbella Ehrenbergii.
" ——— ?
Eunotia obtusa.
" tetraodon.
" Ehrenbergii.
Actinoptychus senarius.
Triceratium punctatum.
Syndendrium diadema.
Synedra crystallina.
" fulgens.
Surirella linearis.

A gathering taken from a thick scum on the surface at the same locality only yielded a small variety of species. *Fragillaria* was the most abundant.

It is very remarkable that the mud furnishes several unquestionably fresh water forms—*Himantidium* and *Eunotia* — the presence of which in such a locality is inexplicable. As already stated there is no current to bring them there, and there are no fresh water streams entering near the place. The only explanation that occurs is, that they may have been brought by some stream entering at a distance, and then blown by the winds upon the surface of the salt water. This is not very satisfactory, but may do until something better is suggested. Will not the composition of this mud serve as an explanation of the formation of the great "infusorial deposits" in Virginia, California, and elsewhere. We have a marine basin completely land-locked, except one narrow channel at a distance, shallow, and free from currents, just the place for a rapid and vigorous growth of diatoms. Here they flourish and decay, together with myriads of infusoria. The silicious shells of the diatoms are deposited with the other organisms; but while all the others are undergoing decomposition and disappear, the silicious diatom shells remain unaltered and accumulate century after century, and must constitute the principal bulk of the deposit, until some physical change or convulsion of the earth's surface excludes the sea, and puts a stop to the growth and accumulation. I hope to be able next summer to explore this place more thoroughly, and to obtain more of the living plants and specimens of the mud at various depths.

February 20, 1867.

Vice President, Mr. T. T. Bouvé, in the chair. Twenty-nine members present.

The Vice President stated that a telegram had been received the day previous, announcing the sudden death of Dr. Henry Bryant at Areceibo, Porto Rico, on the 1st instant, and said: —

Before giving our attention to the scientific and business matters which may come before us, it seems proper that we should allow some expression to the feeling that pervades and deeply saddens our hearts. Again has the Angel of Death entered our ranks, and borne from our companionship one who has been long associated with us in advancing the interests of our beloved Society, and who, by his late munificent donation to our collection, entitled himself to be regarded as one of its greatest benefactors.

Truly in the death of Dr. Henry Bryant, we have met with a great loss, for we have reason to believe that had he lived to return, his interest in our institution would have manifested itself in his daily work; for he repeatedly expressed before last leaving, that when he came home, it would be to remain permanently among us. He strongly sympathized in our wishes to advance the usefulness of this Society by the increase of its collection in different departments, and particularly by its proper preservation and exhibition. Indeed we have lost a friend and brother in our labors, and a benefactor whose unostentatious liberality has enriched our cabinet with its most valuable and attractive objects. It remains for you to take such action as seems to you required by this sad dispensation.

It was voted, on motion of Mr. Edw. Pickering, that a Committee of three be appointed by the Chair to prepare such notice of the professional and scientific life and activity of our deceased friend, as seemed to befit the occasion. Drs. S. L. Abbot and J. C. White and Mr. J. E. Cabot were appointed.

Mr. Edw. Pickering moved the following Resolutions, which were passed:—

Resolved: That this Society, in expressing by this Resolution its appreciation of the munificent bequest of the late Miss Sarah P. Pratt, desires also to convey its thanks to the executrix for the promptitude with which it has been placed in the Society's possession, and the liberality with which the intent of the testatrix has been carried into effect.

Resolved: That the Secretary be requested to send a copy of the foregoing Resolve to the family of the deceased.

On motion of Mr. W. T. Brigham, it was then voted to ad-journ, without the transaction of further business, or the hearing of scientific papers, out of respect to the memory of our late member, Dr. Henry Bryant.

Section of Entomology. February 27, 1867.

Mr. W. T. Brigham in the chair. Eleven members present.

The following paper was read:

ON A METHOD OF STIMULATING UNION BETWEEN INSECTS OF DIFFERENT SPECIES. BY L. TROUVELOT.

It may be of some interest to entomologists, who have had no experience in the subject, to know how coitus can be provoked between insects of different species, or even of different genera. It would be interesting to obtain hybrids from closely allied species, and to ascertain if these hybrids can propagate their new type through many generations. I have in my cabinet a specimen given to me by Mr. Guérin Méneville, which is a hybrid from the ailanthus silk worm (*B. Cynthia*), and the castor oil silk worm (*Bombyx arrindia*). This hybrid is said to be from the twentieth generation.

I have often obtained a union between insects of different genera; of course there was too great a separation between these types to obtain impregnated eggs, and as it is not very easy for one who has no experience to unite successfully different species, I will attempt to give the method which experience has taught me, and which has always been successful.

When the two insects to be experimented upon have been selected, the female should be put in a cage, with another female of the same species as the male of the experiment. Two males of the same species should be kept ready. When the time arrives for males of this species to seek for their mate, they should both be introduced into the cage containing the two females. As this contains a female of their own species, they will soon ardently seek for her. One will soon unite with her. The remaining male, having no female of its own species to unite with, but being excited by the sensation received from the proximity of the object of his desire, will also soon unite with the female of the other species, and with apparently the same ardor as if it were one of its own species. In fact, I do not think that he perceives his mistake, as I believe the only means he has of knowing this, is the sensations received by means of his antennæ.

To make it clear I will illustrate my idea. For instance if it is proposed to unite a male Cecropia with a female Polyphemus, two male Cecropias will be procured, and also a female Polyphemus, and a female Cecropia; the two females should be kept in a cage, and between midnight and one o'clock in the morning — as this time is the best for this species—the two males should be introduced, and they will soon unite. As these insects are of a different genus, of course the eggs will not be impregnated.

March 6, 1867.

Vice President, Dr. C. T. Jackson, in the chair. Forty-four members present.

Dr. J. C. White exhibited a specimen of Guaranâ, moulded into the form of a Juraràca, the most poisonous of Brazilian serpents; it was brought from Brazil by Mrs. Agassiz, and presented to the Society by Dr. B. E. Cotting. The Guaranâ is made from the seeds of the *Paullinia sorbilis*, which are roasted, ground, mixed with water, moulded and dried hard in an oven. It contains a larger quantity of caffeine than either tea or coffee, and resembles in appearance common chocolate; dissolved in water it is used as a refreshing drink, and as a remedy for fever and other ailments. The Mauès Indians, who manufacture it, believe it to be more efficacious when made into the form of a serpent, as in the specimen exhibited.

Dr. S. L. Abbot read the following translation from the *Union Médicale* of Paris, giving an account of the chase and capture of a large male Gorilla:—

M. Henri de Parville gives, in his Review of the Sciences, in the *Constitutionel*, the following interesting details of the capture of a male gorilla:—

A French geologist, a great collector of minerals and animals, at this time in Gaboon, M. A. Berthiol, has sent us some details concerning a male gorilla which he has recently captured, and which is a very fine specimen of these men of the woods, so well described by M. Paul du Chaillu.

The gorilla is larger than the Orang-Outang. His height is as much as two metres and fifty centimetres. His muscular strength is considerable. They are rather numerous in the forests of Western Africa.

In the month of November last, M. Berthiol, having learned that a gorilla had been seen in the neighborhood of his camp, started immediately in pursuit, with a number of negroes. They hunted in vain for him for many days. One morning the hunters were silently making their way through a thick underbrush, when they heard not far off, a sound like the breaking of branches of trees. Then suddenly a terrible cry resounded and froze them with terror. One must have heard the cry of a gorilla to have an adequate idea of it.

"The roaring of this animal," says M. du Chaillu, "is at the same time the strangest and the most fearful sound that can be heard. It begins by a sort of jerking bark like that of an angry dog, then changes into a deep growl, which literally resembles the roll of distant thunder, so much so that at times I have been tempted to believe that it really thundered when I heard this animal without seeing him." Sometimes the cry is single, piercing, short, almost an explosion.

The hunters waited with their guns at their shoulders; the bushes opened. The animal advanced with caution upon his two hind feet, beating his huge chest with his nervous arms. He was about two metres in height. He carried his head erect, and his eyes flashed in the demi-obscurity of the forest.

At about fifteen paces from us, writes M. Berthiol, he stopped, pouring forth roar upon roar. His closed fist threatened us, his jaws displayed his long and pointed teeth. A young tree surrounded by numerous lianas obstructed his passage. He seized it roughly; the tree cracked and fell broken; the animal passed on.

At this moment, Milo, a black, began the attack. A ball whistled and struck the gorilla in the shoulder at the moment when his chest, vigorously beaten by his closed fists, was resounding like a drum. The ape whirled round, uttering a plaintive bark. Then, raising himself, with a bound he advanced. At five paces a second ball struck him full in the chest. He roared fearfully, and with another bound threw himself upon a negro, who escaped him, leaving his gun in his hands. The weapon was flattened and hurled against a tree where it was dashed in pieces. At this moment a shot from a revolver, better directed, brought down the animal.

He was surrounded with great caution, seized by the neck by means of a lasso, then, laid upon some branches, he could be carried to the camp. He appeared to suffer much from his wounds; his barkings were rather plaintive than furious.

M. Berthiol had him shut up in a hut, where he is still in captivity. He roars now every time any one approaches him, and retires into a corner. Although grievously wounded, they do not despair of saving him. He eats well, but still crawls about on all fours; his hair bristles with rage whenever a negro enters the hut. His food has to be left for him at a distance. White men do not seem to make him furious as the negroes do. Therefore M. Berthiol thinks it may not be impossible to save, and even to tame him.

This singular preference of the gorilla for whites rather than blacks occurs in more than one animal.

The lion, in particular, seems to make a very marked distinction between whites and blacks. The Africans themselves recognize it in the precautions which they take in defending themselves; he would throw himself upon a negro, where he would retire from a white man without doing him the least harm. Perhaps they have good reason to distrust a European, whose power they have learnt to their cost.

Dr. Brewer made some remarks on the wood-warblers (*Dendroicæ*) of North America.

This genus was now supposed to contain twenty-two species — two of which are, however, of doubtful distinctness. At least one half of these are migratory birds, known only to most as birds of passage, making brief visits in spring and autumn, and passing their summers north of latitude 44°, and their winters in the West Indies, Mexico and Central America. These birds blend, in a very remarkable degree, the habits of the *Certhiæ*, or Creepers, with those of the true *Muscicapæ*, or Fly-catchers. In some species these habits are equally blended and alternate, as occasion seems to prompt. Some are almost entirely Creepers in habit, others almost exclusively Fly-catchers. Only one of these is known to be at all terrestrial in habit, by choice. This is the Yellow Red-poll Warbler, *Dendroica palmarum*. Two other warblers, either driven by necessity, or tempted by opportunity, feed on, or near the ground, the *D. coronata* and *D. discolor;* but these instances are rare, and in the former bird the act of necessity is so awkwardly done as to betray its being unnatural. The other is no real exception, as it feeds, not on the ground, but only very near it, catching small insects on the wing.

These, as well as other eccentricities of the *Dendroicæ*, appear to be in some degree influenced by the circumstances of their food. Two years since a pair of *D. canadensis* appeared, in the middle of Februrary, in Boston, where for several days they were seen, in excellent condition, busily searching the walls, window seats, etc., for eggs and larvæ of insects.

Dr. Brewer read extracts from papers of Mr. McCulloch, Dr. Bryant and Mr. J. A. Allen, confirmatory of his own observations as to the terrestrial habits, at times, of the Red-poll Warbler. Alone of all *Dendroicæ*, so far as is known, it breeds on the ground. At other times this warbler shows that it can be, when the occasion offers, an expert fly-catcher. Dr. Samuel Cabot, who has frequently observed the Red-poll in the spring, in Massachusetts, among the birch trees, was unaware of its terrestrial proficiencies, but has only noticed it feeding on flies among the tree-tops. When seeking its food on the ground its motion is graceful, easy and natural, demonstrating that it is natural to the bird, and not the prompting of necessity.

Mr. S. H. Scudder placed upon the blackboard a tabular sketch of the various localities in which insects had been found in a fossil state both in Europe and this country, referring them to their geological horizons; in connection with it he gave an account of the various fossil insects hitherto discovered in America.

He exhibited specimens of the fossil larva from the Connecticut River sandstone, which Professor Hitchcock had considered a neuropterous insect, and had named *Mormolucoides articulatus*. The specimens were from the cabinet of the Society, and that of Prof. O. C. Marsh of New Haven. Although they differed from Professor Hitchcock's illustrations, Mr. Scudder believed them to be the same animal, and probably larvæ of Coleoptera.

Mr. T. T. Bouvé, who had seen the originals of Hitchcock and many similar specimens, agreed with Mr. Scudder in referring these remains to the same species.

The Corresponding Secretary read the following letters which had been received since the last announcement:—

From the Portland Society of Natural History, February 4th, 1867; Kongelige Danske Videnskabernes Selskab, Copenhagen, March 31st, 1866; Academy of Sciences of Chicago, January 1st, 1867; Lyceum of Natural History, New York, February 11th, 1867; Regents of the University of Michigan, Ann Arbor, February 15th, 1867; K. Hof- und Staats-Bibliothek, Munich, November 28th, 1866, acknowledging the receipt of the Society's publications. From the Société de Physique et d'Histoire Naturelle de Genève, October 15th, 1866, acknowledging the same, regretting inability to present the first volumes of its Mémoires, and asking for Volume V. of the Society's Journal; Société des Sciences Naturelles de Neuchatel. October 18th, 1866, acknowledging the same and asking for the Journal, etc. From the Götheborg's Kongliga Vetenskaps och Vitterhets Samhälle, Gothenburg, October 10th, 1865, presenting its publications, and accepting the proposition to exchange. From the Naturforschende Gesellschaft zu Halle, May 28th, 1866, presenting its publications. From the K. Bayerische Akademie der Wissenschaften, Munich, December 1st, 1866, acknowledging the receipt of the Society's publications, and presenting its own.

The Custodian stated that the collection of Shells recently bequeathed to the Society by Miss Pratt, contained 14,284 specimens.

Mr. T. T. Bouvé announced the bequest of $20,000 by our late Patron, Mr. Paschal P. Pope.

Mr. T. T. Bouvé and Drs. S. L. Abbot and J. C. White were appointed a Committee to examine the portraits and photographs of the late Dr. Wm. J. Walker and report what steps were necessary to secure a good representation of him.

The following persons were elected Resident Members: Messrs. Francis Brooks, C. P. Donahoe, C. Frank Emmons, J. D. Hague, George J. Harris and Austin Sumner of Boston, and Mr. Henry N. Blake of Chelsea.

March 20, 1867.

Vice President Dr. Charles T. Jackson in the chair. Twenty-nine members present.

The following paper was presented:—

ROCKS IN NATURE AND IN THE ARTS. BY PROF. A. L. FLEURY, OF NEW YORK.

Rocks are the acknowledged foundation, the framework, the skeleton of this our inhabited globe.

No where does nature show her grandeur and majesty better than in the variety, beauty and adaptation of her rocks and stones; they are fully entitled to their rank as symbols of stability, firmness and age; they stand there, the counterparts of the glorious, broad, deep ocean.

The true history of the rocks is still wrapt up in considerable mystery; their conception, birth, growth and maturity are not so easily traced, and though not a few master-minds have given us the results of their investigations and thoughts, the subject is yet incomplete.

In our present progressive age of positive science we are no longer content with the ancient tale, that rocks and mountains appeared on the face of the earth; we want to know more about their "whence and wherefore."

Without entering into the details of cosmogony, geology, or mineralogy, or discussing theories, we will attempt to trace the history of one kind of rocks, the white, beautiful quartz-rock; it is the more interesting, because in it we find embedded most of the precious metals.

As an illustration we will take up a piece of white quartz, containing in its midst, closely fitted, a number of sparkling crystals of gold-like metallic appearance.

In order to know what we have in hand, we will give the piece to an expert chemist for analysis.

The chemist proceeds to examine first its physical, and then its chemical properties. He will carefully observe its color, crystalline structure, test its hardness, and ascertain its specific gravity. He will then pulverize the stone to an impalpable powder and treat it with acids. These, he finds, dissolve the metallic yellow crystals, leaving an insoluble white powder. The tests of the decanted acid liquid show the presence of sulphur and iron. He concludes that he has to do with crystals of sulphuret of iron, the so-called pyrites, or fire stones.*

The remaining white sand is then dried and weighed. In order to test this white powder, the chemist will probably mix it with an alkali, soda or potassa, and melt the mixture to a colorless glass; this he will reduce to powder and gradually dissolve it in boiling water. On adding hydrochloric acid, he will separate the alkali and leave the silica as a *gelatinous* bulky precipitate suspended in the solution of the respective salt. The liquid is decanted and the silica gradually dried and heated to a white heat, after which it is again weighed. It is now *pure silica*, insoluble in any but hydrofluoric acid. We have thus learned something of the peculiar properties of silica or quartz; we have seen it in a *solid*, *semi-solid* or *gelatinous*, and in a *liquid* state, much like carbonic acid, which can be frozen to solid crystalline ice, or to a light flaky mass like snow, or be kept as a refreshing beverage entirely dissolved in water. We will now return to the spot from whence we have taken our specimen and attempt to unravel its history.

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* The ancients denominated these hard crystals fire-stones or pyrites, because they were frequently used instead of flint, as it had been found that when struck with a steel they gave fire like flint.

It is part of a vein, some five feet wide, traversing a solid rock called argillaceous schist. How did the quartz come into this rock? Was it melted by heat and like glass, or scoria, pressed up through the crevice of the rock, or has it, as an aqueous solution, been infiltrated from below and gradually hardened?

Our forefathers were great friends of the igneous theory; they concluded that because they had known and learned of volcanic action lifting up hills and mountains, and were familiar with the fact that certain stones when exposed to great heat can be fused like glass, all rocks, such as granite, gneiss, quartz, etc., were the results of igneous action. It took many years to dissipate this preconceived erroneous idea, in order to give room to a more reasonable exposition of the origin of rocks.

Flint stones of a rounded form were found to contain cavities filled with water; they were called geodes. How could this water come into the stone, had it been melted by fire? Even some quartz crystals, perfectly formed, were found to inclose cavities filled with a liquid. Finely cut laminæ of granite were subjected to microscopic observation and disclosed pores filled with water. It was further observed that quartz veins traversed rocks which were evidently of sedimentary character,—and as they showed no evidence of ever having come in contact with a highly heated liquid mass, where they touch the quartz vein, it was finally concluded that these quartz veins must have been formed by aqueous and not by igneous action.

The question now arises: From whence did the quartz come, and how is it that the sulphurets are inclosed and firmly embedded in its centre?

As none of us were present when this quartz rock was formed, we can only draw our inferences by comparative induction, and thus gradually reach the true cause.

We will again inquire of the science of chemistry, and ask her if she cannot lend us her assistance to unravel this knotty question.

Professor Fremy of Paris, one of our best practical chemists, has examined the chemical properties of silicium and its combinations with chlorine, fluorine, sulphur, iodine, bromine, carbon, and has recently published his results in the Traité de Chimie.

The most important subject for us here, and the one very little known, is his description of the combination of silicium with sulphur, the *sulphide of silicium.* Its bearings on the sciences of geology, mineralogy and metallurgy are such as warrant me in giving you all that is known of it: it explains to us clearly, from whence our quartz comes and how the sulphurets of iron came to be embedded in the same.

Sulphide of silicium ($Si\ S3$) is a solid substance, white, infusible and a little volatile, but it is easily carried along by a current of the vapors of sulphide of carbon; at a very high temperature it sublimes in the shape of silky needles. Nitric acid decomposes the sulphide of silicium; in that case sulphuric acid is formed while silica remains in solution in the nitric acid and the sulphur is left as a bulky precipitate.

Water decomposes the sulphide of silicium, sulphuretted hydrogen is disengaged, WHILE THE REMAINING SILICA DISSOLVES COMPLETELY IN THE LIQUID. ($Si\ S3+3\ HO=3\ HS+Si\ O3.$) This silicious water shows sometimes a remarkable stability, *it can be preserved for months without forming a precipitate of silica*, but when concentrated, the solution becomes gelatinous; the same takes place when brought to the boiling point, or when soluble alkaline salts are introduced into the liquid. When the silicious solution is completely evaporated in vacuum, it leaves a transparent glass-like residuum of hydrated silica, which is *insoluble* in water. This hydrate contains 16.7 *per cent.* of water; it consequently corresponds with the formula ($Si\ O3+3\ HO.$) and can part with about one half of its water; it then contains nine *per cent.*, and its formula is represented by $Si\ O3+2\ HO$ which allies it to certain opals. The sulphide of silicium presents the very curious property *of decomposing at the ordinary temperature under the influence of a humid atmosphere* and forming under this circumstance sulphuretted hydrogen and *anhydrous silica in* CRYSTALS. The silica that is thus obtained *is insoluble in water, but soluble in the solutions of potassa*; consequently it is not of the same nature as quartz. It can be seen from this that the sulphide of silicium in its contact with water, can produce phenomena which greatly add to our interest in the natural history of rocks.

Therefore, admitting the presence of large deposits of sulphide of silicium in the interior of the earth, which are decomposed by water, it is easy for us to explain all the phenomena of petrification, and the silicious incrustations which we observe deposited on organic and inorganic matter in certain localities. By this decomposition we can also explain the formation of silicious waters and such sulphurous springs as contain silica in solution. It has been demonstrated that the Geyser springs of Iceland, which are very rich in silica, contain a considerable quantity of sulphuretted hydrogen; they contain therefore the two elements, resulting from the decomposition of sulphide of silicium. It is also known that silica is always found in sulphur springs. The simultaneous presence of these two products in these waters, (which products are the results of the decomposition of sulphide of silicium under the influence of water), together with the chemical analogy that exists between the silica that comes from the sulphide of silicium and that found deposited from the Geyser springs, (which are equally as soluble in potassa), permit the supposition that the sulphide of silicium is not so rare as we may think at present, and that it is probably produced in all cases where silica is found to be submitted to the action of a binary compound that yields to it its sulphur and takes its oxygen, and that silicious waters can be produced by the decomposition of sulphide of silicium in the presence of water. When sulphide of silicium is heated in a current of humid air, it is decomposed and forms silky crystals of anhydrous silica. In nature we meet certain varieties of silk-like quartz, the formation of which may be due to the same cause.

Here we have a flood of light on the history of our quartz and the inclosed sulphurets; for, it can easily be deduced from the above stated investigations, that as sulphuretted hydrogen can be dissolved in water, it would be decomposed on coming in contact with a dissolved oxide or hydrate of iron, and take the oxygen from the iron, which latter would, in this case, combine with the sulphur of the decomposed sulphuretted hydrogen, and harden to a crystalline sulphuret in the midst of the gradually hardening gelatinous silica. Berzelius at first obtained the sulphide of silicium by passing the vapor of sulphur over heated silicium. This compound is also produced in small quantity by the action of sulphuretted hydrogen on chloride of silicium.

Prof. Fremy prepares his sulphide of silicium by submitting free or combined silica to the action of bisulphide of carbon; this decomposition is much facilitated by mixing the silica with carbon, coal-dust, etc. The silica prepared by chemical process so as to be soluble in potassa, is much easier attacked by bisulphide of carbon than quartz; the same can be said of free silica; however, certain natural silicates, *feldspaths* for example, produce easily sulphide of silicium when heated to a red heat and submitted to the action of sulphide of carbon.

The composition of sulphide of silicium is easily found in decomposing by water a known weight of that body. Sulphuretted hydrogen is thereby disengaged, which is treated by the known method; the liquid is afterward evaporated and the residuary silica weighed. Crystals of quartz, as well as of sulphurets of nearly all metals, have been artificially produced by slow electric action, containing these substances in solution.

The laws of crystallization are yet wrapped in mystery; all we know is, that when a substance is dissolved in a proper menstruum that allows to its atoms or molecules free action, the substance crystallizes according to fixed laws of polarity, whenever the medium that holds it in solution is gradually evaporated.

What governs or conditions these laws, and by what agency crystallization itself is produced, are yet questions to be solved. In magnetism and electricity we may probably find their answer.

Evaporation as well as condensation are sources of electricity. Heat is now acknowledged as a modification of force, and in some instances we have succeeded in converting it into electricity. The condensation of steam where 967 degrees of free heat become latent, seems to be overlooked as a source of electricity. From the accounts of Messrs. Faraday, Becquerel, De la Rive and others, we learn that the hydro-electric machine gives static as well as dynamic effects of electricity—*combining quantity with intensity.* These effects are ascribed to the *friction* of the particles of steam and water against the sides of the outlet pipes. It has been found to take place only at a high pressure and with water free from all foreign substances. The extraordinary amount of dynamic electricity that is produced by steam is certainly not without effect when passing into the interstices of quartz rock, or condensing in a saturated solution of hydrate of silica. Another important crystallizing agent we have in carbonic acid (Bischoff), and water under pressure (Daubrée).

We have thus attempted to trace the probable origin of the quartz rock to the decomposition of sulphide of silicium in the interior of the earth, by water or steam, the solution of the hydrated silica in water, its infiltration into the fissures of the rock, and its final crystallization from a semi-solid gelatinous condition.

Nature has thus pointed out to us the way to produce artificially, and for the benefit of humanity, what she prepares on a gigantic scale in her laboratory. As we live in an eminently practical age, and in a country where the knowledge of natural history can be turned to account, we will add a few practical thoughts upon our subject.

We have seen that nature in her great laboratory can, and does dissolve quartz rock in water by forming and then decomposing sulphide of silicium; that with this liquid hydrate of silica, she can form all kinds of petrifications of animal and vegetable matter, and by mixing with other substances, mechanically or chemically, or both, form an immense variety of stones. She can do it either with or without alkaline agency. We will enumerate a few uses to which the "*liquid flint*" might be brought in the arts:

The first idea that suggests itself, is that of its use for making artificial stones for ornamental and building purposes. By mixing with the petrifying liquid fine white sand or pulverized quartz, marble dust, or other suitable material, we could make statuary, monuments, fountains, columns, in short any ornamental stone, not by a slow process of cutting and chiselling, but by a very quick and most economical process: by simply casting the flint-marble statues like plaster of Paris in moulds, without any heat or pressure. "The building of a temple without the sound of a hammer" might thus be realized, as the cast stones could be cemented together with the same petrifying liquid, and thus make one solid, durable structure.

The cost of white flint-marble statuary, tombstones, monuments, fountains, tables, mantel-pieces, &c., would be much reduced. This art could become what photography is now to painting, a propagating and diffusing agent of the art of sculpture. How quickly and cheaply we could multiply and diffuse the master-pieces of this art, and adorn our public and private buildings, parks and gardens!

The liquid flint might be mixed with proper materials and applied like mortar or plaster of Paris to the outside of our brown stone, brick, and perhaps even wooden houses, giving them the appearance of fine marble buildings. We might cover the walls and ceilings of our churches, halls, theatres, parlors and rooms with a most durable flint coating, colored or painted in fresco. These silicified colors would be as durable as those of Herculaneum and Pompeii. The floors might be inlaid with colored stones, in so-called mosaic style.

Another highly important application of the liquid quartz suggests itself in rendering wood *non-inflammable, rot, and water-proof.* The amount of property lost by fire during the present year will probably reach 100,000,000 of dollars, against 44,000,000 lost during the past year. We could reduce the danger from fire in a great measure by making wood non-inflammable, water and rot-proof. How could this be done? you will ask. Simply by steeping the wood when thoroughly dry in the liquid flint, and then expelling the moisture by proper evaporation. Canvass, cloth and paper might thereby be rendered non-inflammable, rot and water-proof, because the moment we stop up the pores of wood or other texture with a non-conducting substance of heat, and one that next to being incombustible in itself, covers the wood or other fibrous particles with an impervious coating, we not only prevent the wood from burning when coming in contact with flame, but also from decomposition and water. The silicification of house, ship, and bridge timber, of railroad sleepers and cross-ties, telegraphic poles, &c., deserves our full attention. Mixed with paper pulp or other material it might be made into many useful articles, such as trunks, boxes, moulds, parts of machinery, photographic instruments, piano keys, boot and shoe soles, &c.

The petrifying liquid might be used for protecting the bottoms of ships and for the preparation of water, fire, and rot-proof paint, and be an excellent varnish to prevent the oxidation of metals.

As the hydrate of silica dissolved in water prevents decay, it might be used with great advantage for the preservation of our old monuments and stone buildings; many of these are now crumbling down and are in need of some remedy. It would, when mixed with other materials, make an excellent cement to conglomerate particles of coal-dust for fuel.

We might use the liquid flint even for the petrification of dead bodies, either by injecting the liquid into the arteries, or by covering the outside with a preserving stone coating.

Why could we not succeed by its aid in producing cold porcelain, without heat or pressure? This is not impossible, if we remember that the liquid silica becomes hard and insoluble in water after it has lost its water of solution, and has taken up its proper amount of water of crystallization.

Another interesting application could be made of the liquid flint. Should paper or pasteboard be thoroughly saturated with the liquid there seems to be a possibility of preparing non-inflammable, water and rot-proof gas and water-pipes. They would be much lighter and more durable than iron or lead pipes, and cost less. The liquid flint might be used with advantage for lining sulphuric acid chambers, tubs, cisterns, barrels, &c. We might enumerate many more useful applications of the liquid flint, as there is scarcely any branch of the arts or manufactures where it might not be beneficial. We have given some ideas of what *might be done*, we will now state shortly what *has been done*.

Professor Fuchs at Munich, Bavaria, was the first to prepare an alkaline solution of silica in water as far back as 1823; he called that liquid water-glass. It was prepared by fusing 20 to 40 *per cent.* of quartz sand with soda or potassa and charcoal powder to a glass, which was soluble in boiling water; or by treating finely-pulverized flint, or so-called infusorial earth, (Liebig's process) with a strong alkaline lye under pressure of steam. It was, however, soon found that the carbonic acid of the atmosphere, by its stronger chemical affinity for the alkali in the silicate, caused a gradual disintegration of the surface or compound.

Numerous remedies were then suggested to counteract this evil. Prof. Kuhlman, in Lille, France, and Mr. Ransome, in Ipswich, England partially succeeded by subsequent application of the solutions of chloride of calcium and hydrofluoric acid to the surface or to the mass of the stones in extracting the alkali. Mr. Ransome, in England, is now preparing a brown or gray *concrete* stone of considerable durability and hardness. He requires, however, *great pressure* and careful manipulation. No crystalline texture or perfectly white stone, supplanting marble has been produced by him. In this country, a gentleman of New York, Prof. Benj. Hardinge, already, some twelve years back, prepared by a peculiar process, not made public, a solution of silica wherein the silica was largely in excess, and after long years of trials and many experiments, has recently succeeded in *casting* white and colored flint-marble without heat and pressure. By mixing his compound so as to introduce into the mass the exact amount of water of crystallization, and not more, he was able to make stones that crystallize and harden *from the centre outward.*

His samples of snow-white flint-marble, as also his various other stones, will shortly be exhibited in this city, and no doubt excite the attention and approbation of the citizens of Boston.

As this is not a place for advertisement, I omit the details of my lately discovered process for the production of a pure hydrate of silica dissolved in water, with the assistance of electricity and without alkali.

I close with the wish that the many uses of the liquid flint may call forth an ample response for its manufacture in this city, while at the same time the scientific skill of our American chemists and physicists be united in their efforts to study the hidden laws of Nature that are at work in the formation of our rocks.

The Secretary read a paper by Col. Whittlesey of Cleveland on the weapons and military character of the Race of the Mounds. The author brought to notice the curious fact that while extensive fortifications built by the Mound race remain scattered over the plains of Ohio, no weapons formed exclusively for warfare have yet been discovered, nor are there any indications that the defences have ever been attacked. He concluded that the weapons were probably made of wood, and that the fortifications were abandoned on the approach of the foe. He also remarked that while in Europe ethnological writers distinguish the progress of mechanical arts among men as the ages of Stone, of Bronze and of Iron, in the Western States the ancient inhabitants did not follow this order of progress, but rather retrograded. He believed that the European age of Bronze corresponded to the age of Copper in this country, to which the age of Stone had succeeded, and that to this age the Indians of the present day belonged.

Dr. Carl Ritter von Scherzer of Vienna, was elected a Corresponding Member.

Mr. Frank I. Tolman was elected a Resident Member.

Section of Entomology. March 27, 1867.

Mr. John Cummings, Jr., in the chair. Fifteen members present.

Mr. F. G. Sanborn read the following letter from Mr. Tryon Reakirt concerning a colored drawing of a butterfly by Mr. Wm. C. Fish, captured at Sandwich, Mass.

The drawing is a good representation of what Dr. Fisher termed *Argynnis Astarte*, which, having been preoccupied, he replaced by *Ashtaroth*. I consider it, however, only a variety of the female of *Idalia*. It seems to be very rare. I have an example taken on the west side of the Schuylkill. Dr. Fisher's original specimen was captured in New Jersey.

It is somewhat singular that North America should produce exactly the same number of instances of divergence from the normal ♀ type of the *Argynnides* as the Old World, and that the amount of deviation should be so equal. *Arg. paphia*, var. *valesina*, agrees with our *Idalia*, not only in the degree of variation, but in its local distribution; in both, too, the separation from the parent species is but partial. The other species, in which the sexual segregation is complete, are *Diana* and *Sagana* of North China; with the differences of *Diana* you are well acquainted; the ♂ and ♀ of *Sagana* differ still more; when I first saw the ♀, I thought it belonged to the genus *Adolias*.

The drawing is well executed; the white spots on the underside of the wings are brilliantly glossed with silver, otherwise it agrees very closely with my specimen.

Mr. S. H. Scudder exhibited drawings and specimens of fossil insects from the Devonian rocks of New Brunswick.

Six tolerably well-preserved specimens had been obtained by Mr. C. F. Hartt, all belonging to the Neuroptera, but differing so much from any now living, that several must be considered as representatives of new families. They were the earliest traces of insect life yet discovered; the oldest insects previously known, having been found in the carboniferous strata.

Mr. Scudder also exhibited a photograph of another fossil wing, which he had received from Dr. Dawson of Montreal. It had been discovered by Mr. Barnes in the carboniferous rocks of Cape Breton. It was very simple in structure, and probably belonged to the Ephemeridæ, though of gigantic size; he proposed for it the name of *Haplophlebium Barnesii.*

April 3, 1867.

Dr. Charles Pickering in the chair. Thirty-six members present.

The following paper was presented:

METEOROLOGY OF CAPE FLATTERY, WASHINGTON TERRITORY.

BY JAMES G. SWAN.

Having been engaged on the Indian Reservation at Neeah Bay, Cape Flattery from 1862 to 1866, and having during that period furnished to the Smithsonian Institution a regular monthly report of the meteorology, I will herewith present the result of my observations for the years 1863, 1864 and 1865, being three years in which the returns are full and complete. The observations for 1862 extended from June 1st to December 31st, and for 1866, from January 1st to October 1st. These two years, therefore, not being complete, will not be taken into account at this time.

My observations were simply with thermometer and rain guage, no other instruments having been furnished me, nor was it found convenient to obtain them in that remote region.

The peculiarity of the climate is its great humidity.

Cape Flattery lies in latitude 48° 23′ north, longitude 124° 40′ west. It is the southern point at the entrance of the Strait of Juan de Fuca. The general configuration of Cape Flattery may be described as follows: The whole system of mountains forming what is termed the Olympic range, commences near Hood's Canal one hundred miles in the interior from the Pacific, and following down the Strait of Fuca, terminates at Cape Flattery. The highest peak of this range is called Mount Olympus, and is situated near Hood's Canal.

It is eight thousand feet high, and its summit is covered with perpetual snow. From this peak the range is gradually depressed, till, at Cape Flattery, it assumes the character of precipitous and rocky hills, six or seven hundred feet high.

Between De Fuca Strait and the Pacific coast, the peninsula becomes gradually narrower, and finally terminates in a small headland, which at its extremity, curves slightly to the westward.

This small headland is somewhat separated from the larger peninsular to which it is annexed, by a valley which, commencing at Neeah Bay on the north, extends to the south of the Cape. This valley is partly covered with a dense forest of spruce and hemlock, and partly open meadows or prairie land, low and wet.

From the Pacific, or south side of the Cape, a small stream penetrates the marsh, having its head within a few rods of Neeah Bay, and at the highest tides, rendering Cape Flattery almost practically an island. This point, or island, has somewhat of a triangular form, the base of the triangle being attached to the continent, and the opposite vertex projecting boldly into the Pacific Ocean, forming the Cape called Cape Flattery.

The peninsula of Cape Flattery has its northern shores washed by the waters of the Straits of Fuca, and its westerly by the Pacific Ocean.

During the prevalence of southerly winds which bring the rains, it is noticed that the atmospheric currents are affected by the land, and a south, or southwest wind on the coast, is a southeast wind on the Strait. This fact is shown by vessels, which, coming from San Francisco or other southern ports, with a fair wind till they pass Tatooch lighthouse, will find the wind ahead when entering the Straits.

These two winds produce an eddy over the Cape, the same as is produced by two swift currents of water joining each other at an acute angle. Thus it is noticed, that while the wind on the Strait, and outside the Cape, is blowing a strong breeze, it will be nearly calm at Neeah Bay (a small harbor six miles east from Cape Flattery), and masses of clouds seem to collect and pile upon the mountains of the Cape, and discharge their superabundant moisture.

The greatest amount of rain I have recorded for twenty-four hours, fell between 7 A. M. December 16th, 1863, and 7 A. M. of the 17th. During that time, six and nine-tenth inches were precipitated.

The following table will show the temperature and amount of rain for 1863, 1864, and 1865.

The temperature is ascertained by reading the thermometer daily at 7 A. M., 2 P. M., and 9 P. M., and the rain guage examined at 7 A. M. showing the result for the previous twenty-four hours. The figures indicate inches and tenths of inches of rain, and degrees and tenths of degrees of temperature.

Month.	1863.		1864.		1865.	
	Temp.	Rain.	Temp.	Rain.	Temp.	Rain.
January	44.8	16.6	41.	25.5	38.4	8.3
February	39.7	14.2	42.	10.4	37.	9.3
March	44.6	12.4	43.8	14.7	36.7	16.1
April	47.	4.7	46.3	4.2	43.7	6.5
May	51.7	4.6	52.3	1.3	51.	6.7
June	56.6	7.2	55.3	7.1	54.	5.8
July	60.	6.1	56.	1.9	55.3	.3
August	57.	.2	53.5	2.5	56.3	.5
September	57.	11.	54.	5.	53.7	13.3
October	48.7	13.2	48.7	3.5	49.3	8.4
November	40.3	14.7	44.	16.	46.	27.6
December	41.7	27.3	37.	14.5	35.5	14.
Mean Temp. for the year .	49.		47.75		46.34	
Amt. of rain for the year .		132.2		105.6		121.3

The mean temperature for three years, 47.7.

The mean annual rain fall for three years, 119.7 inches.

I have no recent data by me with which to compare the record of the Neeah Bay station with other stations in Washington Territory and Oregon, but from the Army Meteorological Register from 1852 to 1859 inclusive, I make the following extract, which will give a fair approximation to present results.

	Mean Temp.	*Rain.*
Fort Orford, Oregon, from 1852 to 1855, inclusive. 5 years . .	53.62	68.52
Fort Vancouver, W. T., from 1849 to 1855, inclusive. 7 years .	52.65	45.50
Fort Dalles, W. T., from 1850 to 1855, inclusive. 6 years . . .	52.79	14.32
Fort Steilacoom, W. T., from 1849 to 1855, inclusive. 7 years. .	50.82	51.75
Add to this my record kept at		
Neeah Bay, W. T., from 1863 to 1865, inclusive. 3 years. . . .	47.70	119.70

By the above it appears that the temperature at Cape Flattery is lower, and the precipitation of rain much greater than at either of the above stations. The mean annual fall of rain at Astoria, at the mouth of the Columbia River, is about seventy inches, and nearly the same at Shoal Water Bay, and Gray's Harbor, W. T., a greater precipitation of rain being observed on the immediate coast than in the interior.

Although the temperature at Cape Flattery averages lower than at the stations enumerated, yet the climate is milder in the winter. Snow does not fall to so great a depth, nor does it remain on the ground as long as it does further inland.

The greatest depth of snow that I have measured was in 1863, and was fourteen inches on a level. In 1865, the greatest depth was eight inches. In neither instance did the snow remain on the ground over a fortnight.

As may naturally be supposed, the great humidity of the climate in the vicinity of the Cape, makes agriculture a very difficult task. Cereals will not ripen, nor has it been found possible to make hay. The only certain crops are potatoes and root vegetables.

The vicinity of Cape Flattery, however, and all the prairie land on the immediate coast between the Cape and the Columbia River, afford most excellent pasturage for stock, the mildness of the winters allowing them to range about for food without their requiring any other shelter than that afforded by the thick foliage of the spruce and hemlock forests which border and surround all pasture lands. Thunder storms are of rare occurrence, and are only noticed during the winter months. Thunder is most frequently heard during storms from the southeast; but there is nothing like the summer thunder showers of the Atlantic States.

This peculiar weather seems to be confined to the immediate seacoast. For as we proceed into the interior, we find the climate more nearly assimilating with that of the Eastern States, being warmer in summer, and colder in winter than on the coast. Thunder and lightning also are of more frequent occurrence during the summer months.

This has been noticed more of late years than formerly, and the climatic change is undoubtedly owing in a great degree to the large tracts of land that have been cleared or burned over in the interior; but as the country in the vicinity of Cape Flattery is in its primitive state, densely wooded with an evergreen forest, and the ground covered with an evergreen shrubbery, (*Gaultheria shallon*), the climate has not undergone those changes which are noticed in the interior.

During the summer and fall months, there is occasionally a dense fog on the Strait of Fuca, sometimes confined exclusively to the strait and at other times covering the land; and still more frequently assuming the form of clouds, too low to be classed among the recognized forms of clouds, and too high to be classed as fog. These have been termed by me in my reports, as fog clouds. They resemble and assimilate with the nimbus or rain cloud, and at times are accompanied with a fine misty rain.

The winds have not the force on the Pacific that they have in storms on the Atlantic. A hurricane is an unknown occurrence on the northern coast, and the most violent storm that I have recorded did not exceed in force a strong gale, or No. 8 of the Smithsonian Institution indications.

These facts, together with the mildness of the climate, as compared with the same latitude on the Atlantic coast, make navigation less hazardous, and the danger and hardships of a winter's voyage to the Strait of Fuca and Puget Sound far less than a voyage from Charleston to Boston in the month of March.

98 *Newton St., Boston, March* 27, 1867.

Dr. Pickering remarked that the change in humidity and temperature takes place on passing the barrier which the first range of hills interposes to the oceanic winds.

Mr. W. T. Brigham stated that in a storm of a week's duration in the Hawaiian Islands, twelve inches of rain had fallen in a single day, and that during the week thirty-six inches, and in some places forty inches had fallen. In Western India, northeast of Bombay, which is considered one of the rainiest quarters of the earth, two hundred and fifty inches of rain are precipitated during the few months of the rainy season.

Dr. Andrew Garratt exhibited a bony mass taken from the heart of a right whale. The whale was captured south of the Azores, was fat and old, and had been previously wounded behind the heart. The heart, when opened, contained in different cavities two of these masses almost exactly alike. fastened by two knob-like attachments to the under side of the valve near its insertion.

Dr. J. C. White had made an examination of this mass, and found it to consist of an external shell one-eighth of an inch thick, of firm fibrous tissue, with a dense glistening surface like parchment. Within was found a cavity containing an amorphous mass of a brownish spongy matter, somewhat fatty, with a considerable quantity of inorganic salts, carbonate, or phosphate of lime. The mass seemed to be either a coagulum of fibrine, or else a pathological growth from the valves of the heart.

Dr. J. C. White announced some valuable donations from Mr. Francis Brooks, calling particular attention to the model of a horse in papier maché, illustrating all the internal organs of the body in a very delicate manner, together with the nerves, veins and muscles, all of which were named. The thanks of the Society were voted for this, and his other valuable gifts.

Mr. W. T. Brigham read the following notes on the Pinjrapol or Animal Hospital at Bombay: —

Once in a while an account appears of some hospital for horses, for dogs, or even for cats, but I believe that animal hospitals, on the comprehensive scale of the one I am about to describe, are peculiar to the Hindus, whose religion forbids the destruction of animal life.

A space of six or seven acres, in the central portion of Bombay, is enclosed by high walls, and divided into courts or wards for the reception of sick or helpless animals. Passing through a long, irregular lane, I came to the entrance, and was presented to the Hindu gentleman who has the entire charge, and who sent various attendants to show me the different objects. In the first court were sickly cattle of various kinds, any one of which would attract attention in any museum in this country. Two or three had broken legs, one was deformed; but the prevailing trouble among the buffaloes was a disease of the hump. Several had their enormous horns broken in fighting, I was told. No surgical aid seemed to be given, but the animals were well fed and the flies kept from the sores. There was one fine specimen of the Nilghau. Farther on was a ward filled with vagrant dogs, and it seemed as though every form of the canine race had been collected. The long-haired Chinese dog, the pug-nosed Japanese, and the mongrel curs so common in all Eastern cities, with here and there a jackal dog, were crowded, to the number of two or three hundred, into a court where they were well fed, and had quite as much exercise as they desired.

In a tank were numerous tortoises, fish that had been rescued by some benevolent Hindus, and some ducks. On the roofs were large flocks of crows, pigeons, and other birds, carefully watching for the dropping of the animals below. One room was said to be especially appropriated to fleas, and coolies are hired to allow them to feed undisturbed on their bodies, for so much an hour; I did not venture into this room.

Goats, sheep, deer, all had their appropriate place; and in one court were the calves brought by the Hindu milkmen, who could not kill, and who thus got rid of them, the hospital nurses buying milk to feed the unfortunate creatures, who seldom survived.

One of the most curious wards was that appropriated to the monkeys. There were twenty monkeys, apes and baboons, and all but three, I think, were diseased. Ten were dreadfully diseased in the genitals (seven male and three female), and the others were mostly affected with eruptions or sore eyes. Most of them seemed comfortable and kept up an incessant chattering.

There were but few broken limbs, and no monstrosities at the time of my visit, although I was assured that monsters were often brought there, but seldom lived long.

This Pinjrapol is supported by the donations of wealthy Hindus, and employs more than fifty nurses, who form a distinct class. At Baroach, on the Nerbudda, is another similar institution; and that at Surat is said to be the largest in India. In the latter place, in 1772, was an old tortoise known to have been there seventy-five years.

Messrs. Ivory Harmon, Edward T. Bouvé, Wm. Tudor and Martin B. Inches were elected Resident Members.

April 17, 1867.

The President in the chair. Sixty-three members present.

Dr. Charles Pickering called attention to the recent introduction of the house sparrow of Europe into this country. As it threatens great evil, preventive measures should be speedily adopted.

Proofs of its destructive habits were cited from standard authors, showing that the bird had been the acknowledged enemy of mankind for more than five thousand years: when writing was invented, the sparrow was selected for the hieroglyphic character signifying enemy.

Sonnini, in the Dictionaire d'Histoire Naturelle, published in 1817, says:—

"Sparrows are impudent parasites, living only in society with man, and dividing with him his grain, his fruit, and his home; they attack the first fruit that ripens, the grain as it approaches maturity, and even that which has been stored in granaries. Some writers have wrongly supposed that the insects destroyed by them compensated for their ravages on grain; eighty-two grains of wheat were counted in the craw of a sparrow shot by the writer; and Rougier de la Bergerie, to whom we owe excellent memoirs on rural economy, estimates that the sparrows of France consume annually ten million bushels of wheat."

Jardine says that a price is set on their heads because of their severe depredations on grain and garden seed, and Valmont de Bomare, in his Dictionary published in 1791, says that "In Brandebourg, in order to diminish the ravages committed by sparrows, a price is set on their heads, and the peasants are compelled by law to bring in a certain number yearly; in each village there are sparrow-hunters, who sell the birds to the peasants to enable them to pay their tribute. The bird is bold, cunning and quick in discerning snares or devices to frighten them; it breeds three times a year, feeding its young with insects, and especially bees, though its principal food consists of grain. It follows the farmer while sowing, harvesting, threshing, or feeding his poultry; it enters the dove-cot, and with its bill pierces the throats of young pigeons, to obtain the grain in their craw."

That their destructive propensities were popularly known in England, is shown by Cowper's lines:

"The sparrows peep and quit the sheltering eaves
To seize the fair occasion; well they eye
The scattered grain, and thievishly resolved
To escape the impending famine; often scared,
As oft return, a pert, voracious kind."

Dr. White said that he believed their domestic habits had been assigned as the reason for their introduction. These made them useful in destroying the insects infesting trees in the city.

Dr. Charles T. Jackson presented some fossil mollusca from the Green Sand of New Jersey, which he considered closely analogous to, if not identical with, those found in the Green Sand of England and France. The Green Sand itself is of great agricultural importance; mixed with the calcareous marl, it renders the soil exceeding fertile; the overlying soil is a tertiary earth derived from the cretaceous, but is more largely mixed with sand.

Dr. Jeffries Wyman gave an account of an excursion he had recently made to the St. John's River, Florida, for the purpose of examining the Indian antiquities of that region. His attention was especially given to the shell mounds.

These mounds are of two kinds: those on the sea-coast, made of *marine* shells, as at Fernandina and St. John's Bluff, and those found inland, which are composed entirely of *fresh-water* shells. Twenty-eight of the latter, situated between Palatka and Salt Creek, were examined; although they have not generally been attributed to the aborigines, there is now abundant evidence that Indians lived upon them from their commencement up to the time of their completion; pottery, bones of edible animals, such as deer, wild turkeys, ducks, soft-shelled turtles and cat-fish, were scattered through them. Beds of charcoal were found at various depths, resting on calcined shells, and near them were fragments of burnt bone. Ornaments and flint implements were very rare, but at Horse Landing, a few miles above Palatka, a worked flint was discovered by Mr. G. A. Peabody, Dr. Wyman's companion, in the sand under a shell mound eight feet high. The shells entering into the formation of the mounds, are principally of the genera *Ampullaria* and *Paludina* with some *Unionidæ*.

The existence on some of these mounds of live oaks between five and six feet in diameter and estimated to be from three to four hundred years old, the roots of which are confined to the most superficial portions, is an indication that no material change has taken place in them since the coming of the white man. The imbedded bones have lost nearly all their organic matter, and a few of the mounds had a somewhat stratified structure, the result of the successive deposits of layers of sand alternating with those of shells. These deposits could have been formed only when the shells on which they rested were superficial, and appeared to be such as came from an overflow of the river. At the present time, however, the river is not known to reach such an elevation above its ordinary level as would be required to make similar deposits of sand. If they are to be ascribed to such an origin, they must date back to a period when the physical constitution of Florida was different to that now existing. No instruments of any kind were discovered in the different excavations in the mounds, which could be attributed to the white man.

There was a marked variety in the fragments of pottery belonging to different localities. Specimens from the upper portion of the river were slightly ornamented by square and regular indentations; those from the neighborhood of Lake Munroe were marked by complicated figures mostly consisting of combinations of straight lines, traced on the clay with a pointed instrument, while near the mouth of the river, the figures were all stamped and still more elaborate.

Dr. C. E. Ware and Mr. Thomas Gaffield were chosen a Committee to audit the accounts of the Treasurer.

Messrs. R. C. Greenleaf, C. J. Sprague and Dr. Samuel Kneeland, were elected a Committee to nominate officers for the ensuing year.

Mr. Edward Doubleday Harris of Cambridge, Mr. Levi L.

Thaxter of Watertown, and Mr. William S. Hills of Boston were elected Resident Members.

Section of Entomology. April 24, 1867.

Mr. F. G. Sanborn in the chair. Eleven members present.

Mr. S. H. Scudder exhibited several species of *Pezotettix* discovered by Mr. S. I. Smith, some in the vicinity of New Haven, Conn., and others near Norway, Maine; they were new to the New England Fauna. He also exhibited a specimen of *Thecla Clothilde* Edw., taken by Mr. Smith on a low mountain in the vicinity of Norway, Maine.

Prof. A. E. Verrill stated that *Thecla auburniana* Harr., was found abundantly on hill sides covered with red cedar near New Haven, Conn.; he believed that it fed on *Smilax*.

Mr. Edw. Merrill said he had taken a specimen in Waverley, Mass., on the 7th of May.

Prof. Verrill remarked that with the assistance of Prof. S. W. Johnson, he had endeavored to ascertain the chemical character of the odor emitted by *Coreus tristis* and other Hemiptera; he found that it bore most resemblance to the formate of oxide of Anyl, or the formate of anylic ether. It is probable that this substance is its most essential and active ingredient.

In a discussion which followed on the longevity of insects, Prof. Verrill stated that he had recently received a collection of insects from Peru, in which one insect, a longicorn beetle, was still alive; it had been pinned with a large cactus spine, and lived several days after reaching this country, and at least twenty days after impaling. Mr. F. G. Sanborn remarked that the Longicorns were usually short lived; according to his experience, the *Chrysomelidæ* had greater persistence of life than any other beetles; one in his possession had lived several months after impaling, and a *Timarcha* brought by a friend from Egypt, had lived in a box for fourteen months without food. He had also noticed that the unimpregnated females of *Pimpla* lived very much longer in captivity, than individuals which had been impregnated.

Mr. B. P. Mann announced the capture of *Arctia anna* Grote, on the alpine summits of the White Mountains.

ANNUAL MEETING.

May 1, 1867.

The President in the chair. Thirty-four members present.

Mr. S. H. Scudder presented the following Report of the Society's operations for the past year: —

The most important events in the history of the past year have been the death of two of the officers of the Society; the bequests of Miss Pratt and Mr. Pope; the opening of the Lafresnaye collection to the public; the formation of a new Section holding special meetings; the division of one of the departments into two; the measures taken by the Council to furnish all the unfinished rooms in the building; and the establishment of a sinking fund to provide for prospective enlargements of our boundaries.

In the decease of Drs. A. A. Gould and Henry Bryant — so long officially connected with the Society, so prominent in wise counsel, so munificent in gifts — we have met with an irreparable loss. As notices of their lives and services have been prepared by Committees appointed for that purpose, I need only add that, both before and after the death of Dr. Gould, every reasonable measure was taken to secure his Molluscan collection for our Museum, and that had he lived a few months longer, it would doubtless have come into our possession; but the funds of a private Institution could not compete with the treasury of a State-Museum, even had it been desirable to expend so great an amount upon a collection which would largely duplicate our own.

The bequest of Miss Pratt, which included a rare collection of shells, some choice conchological works, and a fund to provide for their care and increase, will be noticed at length in this report.

Nothing could have been more timely than the bequest of Mr. Pope. The necessity of fitting up the lecture room, new exhibition rooms, and another apartment for books, had become so apparent, that we feared our means of usefulness would be crippled, as in former years, by the almost total absorption of our annual income for purposes of construction. The Council have now less hesitation in expending a portion of the principal of the Walker bequest, given, among other purposes, for building, since the donation of Mr. Pope will enable them to supply the lack of annual income. The donation amounted to $20,000.

The lower half of the geological room has been fitted up, workmen are employed on the conchological room, and contracts are either made, or under consideration, for furnishing the lecture room, the lower half of the rear library, and a room to be devoted to Ichthyology and Herpetology. A plan for courses of lectures is before a special Committee, and as our building will probably require additions in ten years, a sinking fund has been established for that purpose, with the money received from the Bulfinch Street Estate.

Twenty general meetings of the Society, one special meeting, and eight meetings of the Section of Microscopy, have been held during the year. A new section for the encouragement of the study of Insects was formed last November through the agency of the Harris Entomological Club; this Club had already been in existence for two years, and was composed exclusively of members of the Society; six monthly meetings of the new Section have been held, and the results have more than met the anticipations of those specially interested in its establishment.

There has been an average attendance of thirty-seven members at the general meetings of the Society; of twelve at the meetings of the Section of Microscopy, and of fourteen at those of the Section of Entomology — a slight advance on the attendance of previous years.

At these meetings, forty-four communications have been presented by thirty-one individuals, viz., thirty-two communications by twenty-six individuals at the general meetings; three communications by two individuals at the meetings of the Section of Microscopy; and eight communications by five individuals at those of the Section of Entomology. Their titles are as follows: —

Dr. S. L. Abbot. Translation of an account of the chase and capture of a male Gorilla, by M. Henri de Parville. *March* 6, 1867.

A. Agassiz. Description of *Salpa Cabotti* Desor. *June* 20, 1866.

Capt. N. E. Atwood. On the habits of our native *Gadidæ*. *December* 5, 1866.

Prof. L. W. Bailey. Note on some peculiar modifications in form of the flowers of *Epigæa repens*. *January* 16, 1867.

Edwin Bicknell. On a sculptured stone from Lake Utopia, New Brunswick. *November* 21, 1866.

W. P. Blake. Note on the occurrence of Gold with Cinnabar in the Secondary or Tertiary Rocks. *October* 3, 1866.

Dr. T. M. Brewer. On the habits of the Yellow Red-poll Warbler. *March* 6, 1867.

W. T. Brigham. The Volcanoes of the Hawaiian Islands. *June* 20, 1866.

Table of Measurements of three hundred Chinese. *December* 5, 1866.

Note on the Pinjrapol or Animal Hospital at Bombay. *April* 4, 1867.

Dr. Henry Bryant. Additions to a List of Birds seen at the Bahamas. *October* 17, 1866.

A List of the Birds of St. Domingo, with descriptions of some new species or varieties. *December* 5, 1866.

Prof. H. J. Clark. On the *Spongiæ Ciliatæ* as *Infusoria Flagellata*, or the structure, animality and classificatory relationship of *Leucosolenia*. *June* 20, 1866.

Prof. A. L. Fleury. Rocks in Nature and in the Arts. *March* 20, 1867.

R. C. Greenleaf. On the Diatoms and other microscopic objects found in Soundings from the Gulf of Mexico, between Sand Key and El Moro. *November* 14, 1866.

Prof. N. M. Hentz. Supplement to the Descriptions and Figures of the *Araneides* of the United States (posthumous paper). *December* 23, 1866.

Dr. C. T. Jackson. On Meteoric Iron from Colorado. *November* 7, 1866.

Dr. B. Joy Jeffries. On the Anatomy and Physiology of the Ciliary Muscle in Man. *May* 16, 1866.

Table of measurements of forty members of the Independent Corps of Cadets. *November* 7, 1866.

Dr. Samuel Kneeland. On a fungoid Parasite or Caterpillar fungus from the Philippine Islands; with remarks by C. J. Sprague on the probable botanical relations of the fungus, and by C. Stodder on a Microscopical Examination of the same. *February* 6, 1867.

Theodore Lyman. On the habits of our river fish and the construction of Fish-ways. *February* 6, 1867.

Horace Mann. Description of the Crater of Haleakala in the Hawaiian Islands. *January* 2, 1867.

W. H. Niles. On the Echinoderm Fauna of the Burlington Limestone of Iowa. *May* 16, 1866.

Dr. A. S. Packard, Jr. View of the Lepidopterous Fauna of Labrador. *October* 17, 1866.

Materials for a Monograph of the *Phalænidæ* of North America. *December* 26, 1866.

Dr. C. Pickering. On the evils threatened by the recent introduction of the House-Sparrow of Europe into this country. *April* 18, 1867.

Tryon Reakirt. On a variation of *Argynnis Idalia*. *March* 27, 1867.

George Sceva. On the cramped feet of Chinese Women. *December* 5, 1866.

S. H. SCUDDER. Results of an Examination of a small collection of fossil Insects obtained by Prof. Wm. Denton, in the Tertiary Beds of Green River, Colorado. *January* 23, 1867.

On the localities of fossil Insects in America and Europe, with remarks on the fossil larva from the Connecticut River Sandstone. *March* 6, 1867.

On the Devonian Insects of New Brunswick, and on a neuropterous wing from the Carboniferous Strata of Cape Breton, Nova Scotia. *March* 27, 1867.

N. S. SHALER. On the formation of mountain chains. *May* 2, and *June* 6, 1866.

Notes on the position and character of some glacial beds containing fossils, at Gloucester, Mass. *October* 3, 1866.

CHARLES STODDER. On Infusorial Earth from Peru. *October* 10, 1866.

On a recent gathering of Diatomaceous Mud at Pleasant Beach, Cohasset. *February* 13, 1867.

JAMES G. SWAN. On the Meteorology of Cape Flattery, Washington Territory. *April* 4, 1867.

L. TROUVELOT. On the reproduction of lost parts in *Phasmidæ*. *November* 28, 1866.

On Monstrosities observed in the wings of Lepidopterous Insects, and how to produce the same artificially. *January* 23, 1867.

On a method of stimulating union between Insects of different species. *February* 27, 1867.

COL. CHARLES WHITTLESEY. On the Weapons and Military Character of the Race of the Mounds. *March* 20, 1867.

DR. BURT G. WILDER. On a cat with supernumerary digits. *May* 16, 1866.

DR. J. WYMAN. Dissection of a young domestic pigeon. *June* 20, 1866.

On the Morphology of the Leaves of *Sarracenia*. *November* 21, 1866.

Notes on the fresh-water shell-mounds of the Aborigines of Florida. *April* 18, 1867.

We have elected during the past year four Honorary Members, seven Corresponding Members, and forty-one Resident Members. Of the latter ten have not yet ratified their election by complying with the regulations of the Society; seven have neither paid the entrance fee nor signed the Constitution; two have signed the Constitution, but have not paid the fee, and one has paid the fee although he has neglected to sign the Constitution.

We have received eleven new subscribers to our Memoirs and nineteen to our Proceedings; others, however, have withdrawn their names, leaving one hundred and seventy-four subscribers to our Memoirs, and two hundred and thirteen to our Proceedings, a number not yet sufficient to cover three-fourths of the cost of printing.

We have issued during the year the first number of our Memoirs in quarto; and the second number is nearly through the press; this is a continuation of the Journal, formerly printed in octavo. We have completed the tenth volume of the Proceedings, and printed the first quarter of the eleventh volume, and the Annual Report for 1866. The Publishing Committee have been authorized to print an octavo volume of extracts from the Entomological Correspondence of the late Dr. T. W. Harris, together with any memoranda left by him, which may be of value to the student or agriculturist. The volume will be illustrated and published independently, possibly as the commencement of a series of similar works.

An Annual of the Society, and a Guide Book to the Museum, will probably be undertaken during the present year.

As the edition of several signatures of the eighth volume of our Proceedings was almost exhausted, the Council recently authorized the reprinting of a small edition of the missing parts. In a few weeks the whole volume can be obtained; the first volume will then be the only one out of print.

Our exchanges with other scientific institutions have been more extensive, both in receipts and in transmissions, than ever before. We have sent away 243 copies of Part I., of our Memoirs, 901 copies of various numbers of our Journal, — 123 of which were imperfect in plates — 539 volumes of our Proceedings, 268 Annual Reports for 1865, and 245 for

1866, an amount equivalent to over 400,000 octavo pages. We are deeply indebted to the Smithsonian Institution for their liberality in transmitting, free of charge, all shipments to and from Europe; by the last Annual Report of the Institution, it appears that the transmissions to and by our Society exceed those of any similiar organization in the country.

In this connection I may refer to my year's absence in Europe, where I sought by every opportunity to advance the interests of the Society. I took with me a detailed list of our incomplete sets of publications of foreign Societies, and in every city through which I passed, made personal application to the officers of these Institutions, for what we needed. Several cities were visited almost solely for this purpose. Whenever other Societies were found with which we made no exchanges, and where such relationship seemed desirable, I made overtures on the Society's behalf, and almost invariably with success. As this method could but partially effect what I desired, I prepared circular letters, setting forth the character of the Society, and its desire to extend its list of exchanges with similar organizations, and sent them to one hundred and eighty institutions in Continental Europe. And here our thanks are specially due to Dr. Felix Flügel of Leipzig, and M. Hector Bossange of Paris; they translated these letters into German and French, aided me in procuring the needed addresses, forwarded them to the quarters designated, and permitted the use of their names as agents of the Smithsonian Institution, through whom replies might be forwarded. Their uniform courtesy in assisting me in every way during my stay in Dresden and Paris, deserves my warmest acknowledgments. In reply to these applications forty-three responses have already been received. Three of the Societies declined the offer simply because they made no exchanges. As the letter requested the exchange of back issues of our respective transactions as well as of future publications, we have been favored with many complete series: this explains the large accession to our Library, and the unusual distribution of our own publications. At the same time, so many promises of extensive series, made to me either in person or by letter, still remain unfulfilled, we may confidently anticipate an equal accession for the coming year.

Our publications are now sent to two hundred and fifty-three different Institutions. The following is a List of forty Institutions with which permanent relations of exchange have been recently effected.

Akklimatisations-Verein	Berlin.
Gesellschaft Naturforschender Freunde	“
Verein von Alterthumsfreunden im Rheinlande	Bonn.
Massachusetts Institute of Technology	Boston.
Vorarlberger Museums-Verein	Bregenz.
Naturwissenschaftlicher Verein	Bremen.
Schlesische Gesellschaft für vaterländische Cultur	Breslau.
Société Botanique de Belgique	Bruxelles.
Société Royale Linnéenne	“
Naturhistorischer Verein	Dessau.
Gelehrte Estnische Gesellschaft	Dorpat.
Gesellschaft für Natur- und Heilkunde	Dresden.
Kön. Akademie gemeinnütziger Wissenschaften	Erfurt.
Società Ligure di Storia Patria	Genova.
Geological Society	Glasgow.
Oberlausitzische Gesellschaft der Wissenschaften	Görlitz.
Kongliga Vetenskaps och Vitterhets Samhälle	Götheborg.
Verein der Aerzte in Steiermark	Graz.
Société des Sciences Naturelles	Groningue.
Institution Teylérienne	Haarlem.
Naturforschende Gesellschaft	Halle.
Wetterauer Gesellschaft für die gesammte Naturkunde	Hanau.
Finska Läkare-Sällskapet	Helsingfors
Medicinisch-naturwissenschaftliche Gesellschaft	Jena.
Naturhistoriske Forening	Kjöbenhavn.
“ Tidsskrift	“
Obshtshestvo Morskaia Wratchei	Kronstadt.
Universitas Carolina Lundensis	Lund.
Société d'Agriculture, Industrie, Sciences et Arts du Département de la Lozère	Mende.
Société Impériale d'Agriculture	Moscou.
Connecticut Academy of Arts and Sciences	New Haven.
Odesskoe Obshtshestvo Istorii i Drevnostei	Odessa.
Société d'Anthropologie	Paris.
Société Impériale et Centrale d'Horticulture	“
Conchological Section of the Academy of Natural Sciences	Philadelphia.
Entomological Society	“
Meklenburgischer patriotischer Verein	Rostock.
Allgemeine Schweizerische Gesellschaft für die gesammten Naturwissenschaften	Switzerland.

Société Academique du Département de l'Aube . . Troyes.
Kön. Kais. geographische Gesellschaft . . . . . Wien.

The following table gives a summary of the additions to the Library by volumes, parts of volumes, pamphlets, maps, or charts:

	8vo.			4to.			folio.			Maps and Ch'ts	
	vls	pts	ph	vls	pts	ph	vls	pts	ph		To'l
Books presented by individuals . .	36	6	114	8		17		2	4	32	219
" received by the Pratt Bequest	22	2		3							27
" purchased	92	11	7	36		8	5	5			164
" deposited by the Republican Institution	23										23
" received in exchange . . .	355	410	92	108	197	27		109			1298
Total .	528	429	213	155	197	52	5	116	4	32	1731

The accessions to the Library have never been so large, excepting in 1864. We then received the bequest of the extensive botanical library of Dr. Greene, and the number reached 1748.

The greater part of the purchased books I obtained myself in Europe, the Council having appropriated several hundred dollars to that purpose.

The most important private gift to the Library was the bequest of Miss Pratt;—by it we received a complete set of Kiener's Spécies Général et Iconographie des Coquilles Vivantes, and a few other conchological works.

Some progress has been made in the perfection of the internal arrangements of the Library. The preparation of an alcove catalogue has been commenced, and the card catalogue has been arranged in trays, after the plan recommended by the Librarian in a previous report.

The Transactions of Societies have increased so rapidly that they require much more space than formerly; for this reason, the Periodicals and all works on Articulates, Mollusks and Radiates, have been removed to temporary cases in the back library. That room is now fitting up with new cases, which will provide ample space for the books in our possession, and for the natural expansion of the Library for several years to come. For the last two years the pamphlets have remained in the condition previously reported; much work must be accomplished before they can be made readily accessible. As the Council have recently increased the assistance in the Library one-half, a portion of the unfinished work may be completed during the coming year; an unusual amount of labor will, however, be entailed by the changes incurred in fitting up the rear Library. The number of books which require binding is exceedingly great.

Five hundred and sixty-one books have been borrowed from the Library by seventy-three persons.

The number of visitors to the Museum has increased in the past year, but the enumeration must necessarily fall short of the actual number who come. The building has been open to the public one hundred and one days; previous to the exhibition of the Lafresnaye collection of birds, in September last, the average attendance was two hundred and fifty-seven; subsequent to that, three hundred and fifty-two, an increase of one-third. The average of the whole year was three hundred and thirteen. The greatest number of visitors during any one day, eight hundred and forty-six.

The Conchological cabinets bequeathed by Miss Pratt formed by far the most valuable accession to the Museum during the year. In the other departments the donations were less numerous than usual. Special mention should be made of the volcanic minerals given by Mr. Brigham, the donation to the Anatomical Department by Mr. Brooks, and the suite of fossils purchased of Dr. Hayden.

The additions to the Museum amount to 20,148 specimens received in 189 lots from 82 different sources.

Owing to the establishment of an Ethnological Museum in our vicinity, on an independent basis, with a large endowment, it has been thought best to give up the department of Ethnology, and to store our collections until they could be satisfactorily exchanged.

The additions to that department have been very slight, consisting chiefly of various implements belonging to differerent nations. The donors were the Rev. Edw. Johnson, Dr. G. H. Brown, and Messrs. W. T. Brigham, J. C. Brown, Jr., Wm. Munroe and F. G. Sanborn.

The accessions to the department of Comparative Anatomy and Mammalogy have been as follows: skeletons, 3; parts of skeletons, 19; skulls, 12; skins of mammals, 2; mammals in spirits, 1; total 47.

The articulated skeleton of a pony, and a very valuable model in papier maché, illustrating the complete anatomy of the horse, were presented to the Society by Mr. Francis Brooks. The skeleton of an Asiatic elephant was also purchased.

During the past two months, this collection has been removed from the cases, cleaned, and to some extent rearranged. It is now in excellent condition, and contains about twelve hundred specimens on exhibition.

The Council have recently made an appropriation to cover the expense of preparing and mounting the mammal skins which have never been exhibited in our present Museum; when ready for exhibition, the ethnological collections will be removed to make place for them.

The donors to this department were Drs. J. N. Borland, F. H. Brown, H. Bryant, J. W. Merriam, W. M. Ogden and H. C. Perkins, Miss Carrie Porée, Messrs. F. W. Andrews, Joseph Ballard, W. T. Brigham, Francis Brooks, G. R. Hemming, H. Mann, S. Mixter, F. G. Sanborn, S. H. Scudder, J. G. Swan and J. F. Wallboum. We are also indebted to the Academy of Natural Sciences of Philadelphia.

Since the last annual meeting the invaluable Lafresnaye Collection of Birds has been opened to the public. The Society is under great obligations to Dr. J. C. White for his voluntary labor in the arrangement of the collection, during the absence of the late Curator. The space conceded to the department was all that could then be spared in justice to the other collections; now that new rooms are to be opened, a considerable expansion is highly desirable. During the few weeks that Dr. Bryant spent here, just before his death, he transferred some of the families to cases in the main hall emptied for their reception; this somewhat impaired the unity of arrangement, but the birds presented a more attractive aspect, they could be more readily examined and were rendered safer from the depredations of insects. Every reasonable precaution has now been taken to protect them from the exposure to light complained of in the Curator's former reports.

The donations to the collection have not been very important; eighty-three specimens have been presented, one specimen has been purchased. Our thanks are due to Drs. S. A. Bemis, H. Bryant and S. Cabot, Maj. Lewis Cabot, Capt. Taylor and Messrs. W. T. Brigham, N. P. Hamlen, H. L. Lawrence, H. Mann and F. G. Sanborn.

Messrs. Luther Hills, Thomas J. Lee and E. L. Sturtevant have made small donations to the department of Oölogy, and Mr. B. P. Mann has presented his whole collection of birds' nests and eggs. The Curator has taken measures to secure large additions during the coming year.

The excessive price of alcohol has prevented the Curator of Herpetology from doing much beyond actually preserving the collection under his care. A short time ago, all the specimens on exhibition were removed to one of the unfinished apartments, to make room for the expansion of the collection of birds; the Committee of Construction are now making contracts for furnishing a new room; the gallery will be devoted to this department, and the specimens placed on exhibition as soon as the cases are completed.

Dr. A. C. Garratt, and Messrs. F. W. Andrews, R. C. Greenleaf, F. G. Sanborn and C. A. Stearns, have made slight additions to the collection.

The cost of alcohol has also prevented the Curator of Ichthyology from paying such attention to his department as would have been desirable. He has endeavored to preserve the specimens from destruction, but they are suffering for want of an arrangement which can not be effected until an appropriation is made for bottles, alcohol and other necessary expenditures. The removal of the tax on alcohol used in scientific museums, has greatly reduced this most expensive item, yet the Curator estimates his present needs at from ten to fifteen hundred dollars. He is especially desirous of exhibiting a perfect collection of the fishes of this State; this would involve a further expenditure of one thousand dollars.

Owing to alterations in the Museum, much time has been spent in changing the specimens from place to place; they are now finally stored, awaiting the completion of the room destined for their reception.

On account of our inability to take care of specimens preserved in alcohol, no effort has been made to increase the collection, and but few donations have been made; for these we are indebted to Dr. A. C. Garratt, Capt. N. E. Atwood, and Messrs. F. W. Andrews, W. T. Brigham, C. G. Bush, H. D. Child, W. B. Fletcher, G. D. Oxnard and James G. Swan.

In the department of Entomology, Messrs. F. G. Sanborn and G. D. Smith have continued their work of preparing the Coleoptera for exhibition, and Mr. Sanborn has spent much time upon the arrangement of some of the nocturnal Lepidoptera. Mr. P. R. Uhler has returned most of the Hemiptera upon which he has been working for some years past. The Curator himself has been unable to pay any special attention to the arrangement of the specimens, and but little to their preservation. By the application of rubber tubing and forcing screws, the cases in which the insects are displayed have been made nearly air-tight; the glass in the sashes has been protected by a railing, and green shades will soon be placed over the cases to shield the specimens from the light.

At the request of the Curator, the temporary services of a competent person have been secured, and the collection will soon be placed in a condition of greater safety; there will be a preliminary arrangement of the insects in cases where they can be examined to much better purpose than is possible in their present condition.

As this section has a greater number of working members than any other, it has recently petitioned for a separate apartment; the labor is now carried on, at much inconvenience, in the office-room of the Custodian. The insect-cabinets are also scattered through various unfinished rooms in different parts of the building: as all of these rooms are to be fitted up at once, no place will remain in which the cabinets can be deposited. It has been suggested that one of the high-studded working rooms might be divided into two; this would secure the collection from the danger of further removal, and provide all necessary light and room.

During the year, Messrs. Sanborn and Smith have presented us with forty-five Coleoptera, of thirty different species, especially selected to fill breaks in our series. The Society is much indebted to these gentlemen for their continued labors in this department, and for the neatness and satisfactory character of their work. We are also indebted to Mr. Samuel Hubbard of San Francisco, for a collection of nearly two hundred Coleoptera from Lower California, and to the following persons for miscellaneous donations: Drs. S. A. Bemis, H. Bryant, A. C. Garratt, S. Kneeland, A. S. Packard, Jr., Capt. W. T. M. Ball, and Messrs. F. W. Andrews, T. T. Bouvé, W. T. Brigham, Edw. Burgess, A. Chapman, H. Davis, R. C. Greenleaf, Benj. D. Hill, Jr., Luther Hills, John Maury, H. H. Rönne, F. G. Sanborn, S. H. Scudder, C. A. Stearns, C. K. Stevens and C. Stodder.

Our small collection of Crustacea and Annelids has not materially increased. A number of specimens from Maine and Labrador have been labelled and placed on exhibition, and the collection is in good order. The only additions are due to the kindness of Rev. Edw. Johnson and Messrs. F. W. Andrews, R. C. Greenleaf, F. G. Sanborn and C. A. Stearns.

The Conchological department, which the active interest of Gould, Binney and Couthouy had formerly placed in advance of all our other collections, has been once more enriched by the bequest of Miss Pratt. Her collection was one of the finest private general collections in the country, and by far the largest ever given to the Society; it contains 14,284 choice specimens in the very best condition. The genera Marginella, Pyramidella, Murex, Haliotis, Conus, Oliva, Cypræa, Rostellaria, Ancillaria, Bulla and Argonauta are remarkable for the beauty and variety of the specimens; the Pulmonifera, particularly the exotic forms of Bulimus and Achatina, form one of the most important parts of the collection. As the bequest included a fund of ten thousand dollars to provide for the care and increase of the collection, the services of a conchologist have been secured, and the furnishing of the exhibition room is nearly completed.

Apart from Miss Pratt's collection, 1,484 specimens have been added to this department. The Curator would again call special attention to the necessity of procuring specimens preserved in alcohol for the study of the soft parts,—the only large collection of this kind was presented by Mr. S. H. Scudder; it contained two hundred and fifty specimens of land and fresh water shells, collected in Texas.

Nearly one thousand shells from the Hawaiian and Marquesas Islands have been presented by the Rev. Edw. Johnson. The other donors to this department are Dr. S. Kneeland and Messrs. David Baker, W. T. Brigham, H. D. Child, H. Davis, Seth Goldsmith, Luther Hills, W. L. Robinson and R. E. C. Stearns.

The labor of identifying, labelling and cataloguing the Radiates has been much advanced during the year. The want of alcohol and bottles prevents the arrangement of the small but valuable alcoholic collection, but it has been examined and most of the species identified; the final labels have been written for a portion of the dried corals and echinoderms. Eleven donations have been received, containing two hundred and seventy specimens of about seventy-two species. The greater part came from the Hawaiian Islands, and were the gift of Messrs. Brigham and Mann. Capt. R. C. Adams presented twenty-three specimens of twelve species of corals from the East Indies, and Rev. Edw. Johnson eight specimens of eight species from Micronesia. All these specimens have been labelled and arranged.

The Curator has also labelled for the Society a collection of East Indian corals, chosen from the duplicates of the Essex Institute, and another of Echinoderms and corals from the west coast of America, received in exchange from the Museum of Yale College; these collections have not yet been forwarded. Donations have also been presented by Messrs. F. W. Andrews and S. H. Scudder, and Capts. N. E. Atwood and Edmund Smith.

The Microscopical collection is in good condition and has received additions at nearly every meeting of the Section. These meetings have been growing in interest, and the attendance has considerably increased. The donations, consisting principally of mounted Diatomaceæ, with some rough material, were presented by Dr. C. F. Crehore and Messrs. C. G. Bush and Wm. Munroe.

Another case has been provided to accommodate the extensive herbarium in the Society's possession. The plants are in good order, and during the early portion of the year, much labor was expended in gluing the specimens upon stiff paper; this was a continuation of the work of the previous year. There have been but few accessions to the collection; most of the specimens were such that they required to be exhibited on shelves.

A small but interesting collection of Gnaphalium leontopodium from the Tyrol and the Erzgebirge of Saxony, illustrating the variations caused in the same individual by differences of warmth, exposure and height, was presented by Mr. S. H. Scudder. Some additions have been received by exchange; for the rest the Society is indebted to Drs. H. Bryant, E. P. Colby, B. E. Cotting, A. A. Gould, S. Kneeland, Ferd. Müller, and C. Pickering, Prof. Gunning, and Messrs. W. T. Brigham, Francis Brooks, C. L. Brown, H. W. Haynes, H. Mann, C. A. Olmsted, H. H. Rönne, and S. H. Scudder.

There has been little change in the Palæontological department; the donations have been very acceptable, but neither numerous nor rare. The Tertiary fossils collected by Dr.

Hayden in the "Mauvaises Terres" of Nebraska, formed the most valuable accession; they consisted principally of remains of turtles and skulls of mammals; for the identification of the species we are indebted to the kindness of Dr. Leidy. The department is under obligations to the Academy of Natural Sciences of Philadelphia, as well as to the following persons for donations: Drs. C. T. Jackson, F. V. Hayden, H. C. Perkins, and J. Wyman, and Messrs. C. G. Bush, H. Davis, B. F. Mudge, S. H. Scudder, James G. Swan and Joseph Wagner.

The department of Geology has been recently separated, as in former times, from the department of Palæontology; a room has been furnished, and preparations made for exhibiting specimens of rocks, building stones, models of surface geology, and whatever may tend to illustrate the department. This room will soon be opened, but series of our most common rocks are still much needed. A large geological map of this and the neighboring States, geological sections, models of mines or of strata, views and photographs of scenery exhibiting remarkable geological formations are most desirable. Printed circulars have been sent to all the principal quarries of Vermont, and to the architects and stone dealers in this city, inviting donations of specimens of building stone. A valuable gift has been received from the Curator, in the large collection of volcanic minerals, made by himself, in 1864–5, in the Hawaiian Islands. It comprises many hundred specimens, and forms the most complete collection of the kind ever brought from that locality. It has been recently unpacked and, in great part, labelled and arranged for exhibition. The collection has received donations from Drs. A. C. Garratt and F. V. Hayden, and from Messrs. H. A. Lawrence, F. G. Sanborn and G. B. Towle.

The condition of the Mineralogical cabinet is very good; the specimens are all labelled and well arranged for exhibition. Considerable work has been expended upon them by the Curator, and small but valuable donations of ores and other minerals have been received from Drs. C. T. Jackson,

A. S. Packard, Jr., and H. W. Williams, Capt. Taylor and Messrs. G. A. Boardman, T. T. Bouvé, W. E. Coffin & Co., C. S. Hollowell, J. M. Horner, William Munroe and C. J. Sprague.

The necessary expenditures for construction, during the year, have doubtless been injurious to the special interests of the Museum, but as our annual income will no longer be taxed for those purposes, we may hope for larger accessions in the future. We have already taken steps in that direction by coöperating with the Smithsonian Institution in their explorations over the unsettled portion of our country. New fields of interest will thus be opened, and we shall secure for ourselves larger and more desirable results than could be gained by independent efforts alone.

Mr. Edward Pickering presented the following report of the Treasurer for the past year:

The Receipts and Expenditures for the year ending April 30th, 1867, have been as follows:

Receipts.		
Dividends and Interest		$9,843.08
Annual Assessments		1,200.00
Admission Fees		165.00
Courtis Fund Income		180.00
Walker Fund " (one half.)		1,233.15
H. F. Wolcott Fund Income		375.00
S. P. Pratt " "		285.00
Total		$13.281.23
Expenditures.		
New Building, Furniture and Grounds.	$2,404,31	
Repairs of New Building	401.90	
Cabinet	1,281.53	
Library	579.62	
Library Fund	203.86	
Memoirs and Proceedings	1,364.46	
Salaries and wages	3,130.10	
Fuel	406.40	
Insurance	138.58	
Appropriation for Foreign Periodicals	161.14	
General Expenses	813.55	$11,022.93
Excess of Receipts over Expenditures		$2,258.30

The following is a statement of the Property of the Society, exclusive of the Cabinet and Library which are not susceptible of an accurate valuation.

New Building.			
Building and Furniture, at cost, as per last Report		$110,037.15	
Expended during the year		2,404.31	$112,441.46
Bulfinch St. Estate Fund.			
Note secured by mortgage		$15,000.00	
U. S. 7.30's		5,550.00	
Cash in the hands of Trustees		118.21	20,668.21
Courtis Fund.			
Notes Receivable secured by mortgage			3,000.00
There is also due to this Fund from the Treasury the sum of $8,339.71.			
Walker Fund.			
Notes Receivable secured by mortgage		$41,105.00	
Cash in the hands of Trustees		1.21	41,106.21
H. F. Wolcott Fund.			
$5000 U. S. Treasury 7.30 Notes			5,000.00
S. P. Pratt Fund.			
$10,000 N. Y. Central Railroad Bonds, 6's			9,400.00
W. J. Walker Bequest.			
17 Shares Bates Manufacturing Co.	per sh. $130	$2,210.00	
35 " Everett Mills	" 146	5,110.00	
30 " Hamilton Woollen Man. Co.	" 275	8,250.00	
1 " Lawrence Man. Co.	"	750.00	
80 " Washington Mills	" 150	12,000.00	
12 " Cocheco Man. Co.	" 750	9,000.00	
2 " Lowell Man. Co.	" 900	1,800.00	
4 " Laconia Man. Co.	" 1150	4,600.00	
3 " Pepperell Man. Co.	" 1000	3,000.00	
25 " Essex Co.	" 108	2,700.00	
100 " Old Colony and Newport R. R. Co.	" 90	9,000.00	
110 " Vermont and Canada R. R. Co.	" 100	11,000.00	
3 " Cape Cod R. R. Co.	" 65	195.00	
11 " Neptune Ins. Co.	" 170	1,870.00	
18 " Boston Ins. Co.	" 100	1,800.00	
$10,000 Vermont & Canada and Vermont Central Chattel Bonds.		10,350.00	
$10,000 Albany City Bonds		9,350.00	
$10,000 Chicago & N. Western Railroad Eq. Bonds		10,000.00	102,985.00
Miscellaneous.			
Unsettled Accounts			57.92
Total			$294,658.80
Deduct Indebtedness		$3,579.50	
Less Cash in hands of Treasurer		3,374.11	205.39
Net value of Property			$294,453.41
Value of Property as estimated May 1, 1866			279,784.43
Increase			$14,668.98

Since my last Annual Report we have received the additional sum of $10,000 from the executors of the estate of Dr. W. J. Walker. The distribution of the residue of his devise awaits the decision of the Supreme Court of the United States upon the questions which have arisen in the settlement of his estate. The bequest by Miss S. P. Pratt of $10,000 in addition to her cabinet of shells, it will be observed, has been paid over to the Society. The bequest of $20,000 by the late Paschal P. Pope has been also announced.

I estimate the necessary expenses of the ensuing year at the same amount as those of the past year.

By a vote of the Council the income of the Bulfinch Street Estate Fund is to be reserved by the Trustees for accumulation as a Building Fund.

All of which is respectfully submitted,

E. Pickering, Treasurer.

Mr. T. T. Bouvé, on behalf of the Trustees, presented the following report for the past year:

DR. THOS. T. BOUVÉ, CHAS. J. SPRAGUE, AND EDWARD PICKERING, TRUSTEES OF THE COURTIS FUND IN ACCOUNT WITH THE BOSTON SOCIETY OF NATURAL HISTORY. CR.

1867. Feb'y 4.	To Cash received	$180.00	1867. Feb'y 4.	By Cash paid to Edward Pickering, Treasurer of the Society, towards General Expenses	$180.00

Errors Excepted. Boston, April 30, 1867.

THOS. T. BOUVÉ,
E. PICKERING,
CHAS. JAS. SPRAGUE, } TRUSTEES.

April 30, 1867.	The Property of the Courtis Fund on date consists of	
	Indebtedness of the Society for cash loaned the Treasury without interest	$8.339.71
	Note secured by mortgage on the Warren Street Chapel	3,000.00
		$11,339.71

Dr. THOS. T. BOUVÉ, CHAS. J. SPRAGUE, AND EDWARD PICKERING, TRUSTEES OF THE BULFINCH STREET ESTATE, IN ACCOUNT WITH THE BOSTON SOCIETY OF NATURAL HISTORY. Cr.

1866. May.	To Cash received of Mrs. Clarke, for rent of house one and one-third mos., to 24th inst.		$111.11
	Taxes for past six months		158.00
	Old Carpeting		9.89
June.	" rec'd from the Estate sold May 24th, at auction to J. B. Smith, the same being with the consent in writing of the Supervisors	$20,700	
	Less am't of Mortgage Note rec'd in part payment as per agreement, three y'rs, Int. payable semi-ann'lly	15,000	5,700.00
" 14.	" rec'd Int. one day on U. S. Bonds purchased		1.11
Dec. 21.	" rec'd Int. on U. S. Bonds		202.57
" "	" rec'd of J. B. Smith, six mos. Int. on his Note acc't $15,000		450.00
			$6,632.68

1866. May.	By Cash paid for water rent	$20.00	
	Less rec'd of Mrs. Clark	10.00	$10.00
"	" paid Alex. Wadsworth's bill surveying Estate preparatory to sale		15.00
June.	" paid W. J. Bowditch, bill for drawing deed and copying	$27.40	
	Stamps	21.00	
	one half recording Mortgage	1.50	49.90
"	" paid Henshaw & Bro., bill commissions on sale	$103.50	
	Tax one forty-seventh	51.75	
	Advertising and Plans	52.00	207.25
" 14.	" paid for $5,550 U. S. 7.30 Notes, at 102 13-16ths		5,706.10
Dec.	" paid for $500 U. S. Notes		526.22
			$6,514.47
1867. April 30.	" Balance on date		118.21
			$6,632.68

Errors Excepted. Boston, April 30, 1867.

THOS. T. BOUVÉ,
E. PICKERING,
CHAS. JAS. SPRAGUE,
} TRUSTEES.

April 30, 1867.	The Property of this Fund on date consists of	
	J. B. Smith's Mortgage Note	$15,000.00
	U. S. 7.30 Bonds	6,050.00
	Cash on hand	118.21
		$21,168.21

Dr. Thos. T. Bouvé, Chas. J. Sprague, and Edward Pickering, Trustees of the Walker Fund, in Account with the Boston Society of Natural History. Cr.

1866. April 30.	To balance of this Acc't as ren'd on date .	$1.380.10	1866. May.	By Cash paid to Trustees of Walker Prize and Special Exp's Fund, balance on hand April 30th, this being one half of the whole sum rec'd from the commencement of the Walker Fund to date,—less sundry amounts charged for articles rightly payable from this Fund	$1,380.10
Sept. 21.	To Cash received six months' interest on Mortgage Note for $25,000 .	750.00	Sept. 21.	" paid Treasurer of the Society one half of am't rec'd on date . .	375.00
Oct. 6.	" received six months' interest on Mortgage Note for $16,105 .	483.15	"	" paid Trustees Walker Prize and Special Ex. Fund, one half of am't rec'd on date . . .	375.00
1867. March 13.	" received six months' interest on Mortgage Note for $25,000 .	750.00	Oct. 6.	" paid Treasurer of the Society .	241.58
April 5.	" received six months' interest on Mortgage Note $16,105 . .	483.15	"	" paid Trustees Walker Prize and Special Ex. Fund . . .	241.57
			1867. March 13.	" paid Treasurer of the Society .	375.00
			"	" paid Trustees of Walker Prize and Special Ex. Fund . . .	375.00
			April 5.	" paid Treasurer of the Society .	241.57
			"	" paid Trustees Walker Prize and Special Ex. Fund . . .	241.58
		$3,846.40			$3,846.40

Errors Excepted. Boston, April 30, 1867.

THOS. T. BOUVÉ,
E. PICKERING,
CHAS. JAS. SPRAGUE, } Trustees.

April 30, 1867.	The Property of this Fund on date, consists of	
	Note of March 1st, 1865, payable in ten years, secured by mortgage, for	$25,000.00
	Note of April 7th, 1865, payable in five years, secured by mortgage on house in Beacon street . .	16,105.00
		$41,105.00

Dr. Thos. T. Bouvé, Chas. J. Sprague, and Edward Pickering, Trustees of the Walker Prize Fund, in Account with the Boston Society of Natural History. Cr.

Date		Amount
1866. May.	To Cash rec'd from Trustees of "The Walker Fund," one half of the whole am't rec'd by them to this date, less some special expenses paid by them on this acct., all in accordance with the contract between Dr. Walker and the Society . .	$1,380.10
Sept. 20.	" rec'd, Interest on Bonds . . .	47.45
" 21.	" rec'd from Trustees Walker Fund one half am't rec'd by them to date	375.00
Oct. 6.	" rec'd from Trustees of Walker Fund one half am't rec'd by them to date	241.57
1867. Feb. 7.	" rec'd for Interest on Bonds . .	61.55
March 13.	" rec'd from Trustees Walker Fund	375.00
April 5.	" " " " " "	241.58
		$2,722.25

Date			Amount
1866. May.	By Cash paid for $1000 U. S. Bonds	$1,002.50	
	116 days Int.	23.20	
	$300 U. S. Bonds	300.75	
	85 days Int.	5.10	$1,331.55
Sept. 20.	" paid for $400 U. S. Bonds and Int.		431.76
1867. Feb.	" " $300 " "		319.11
March.	" " $350 " "		372.00
April 5.	" " $250 " "		266.62
			$2,721.04
April 30.	" Balance to acc't on date . . .		1.21
			$2,722.25

Errors Excepted. Boston, April 30, 1867.

THOS. T. BOUVÉ,
E. PICKERING,
CHAS. JAS. SPRAGUE, } Trustees.

April 30, 1867.	The Property of this Fund on date consists of	
	United States Bonds which have cost	$2,721.04
	Cash balance on date	1.21
		$2,722.25

DR. THOS. T. BOUVÉ, CHAS. J. SPRAGUE, AND EDWARD PICKERING, TRUSTEES OF THE WOLCOTT FUND, IN ACCOUNT WITH THE BOSTON SOCIETY OF NATURAL HISTORY. CR.

1866.			1866.		
June 20.	To Cash received, Interest on U. S. Bonds	$182.50	June 20.	By Cash p'd Treasurer for purchase of Books	$182.50
Dec. 19.	" " " " "	182.50	Dec. 19.	" " " " "	182.50
		$365.00			$365.00

Errors Excepted. Boston, April 30, 1867.

THOS. T. BOUVÉ,
E. PICKERING,
CHAS. JAS. SPRAGUE, } TRUSTEES.

April 30, 1867.	The Property of this Fund on date consists of $5,000 U. S. Bonds 7.30, 1865, Nos. 169,038–169,072 inclusive	$5,000.00

DR. THOS. T. BOUVÉ, CHAS. J. SPRAGUE, AND EDWARD PICKERING, TRUSTEES OF THE PRATT FUND, IN ACCOUNT WITH THE BOSTON SOCIETY OF NATURAL HISTORY. CR.

1867. April 17.	To Cash received, three per cent. on $10,000 New York Central Railroad Bonds, less Tax	$285.00	1867. April 17.	By Cash paid to the Treasurer of the Society towards the payment to be made by him for studying and arranging in scientific order the Conchological Collection in the new Cases	$285.00

Errors Excepted. Boston, April 30, 1867.

THOS. T. BOUVÉ,
E. PICKERING,
CHAS. JAS. SPRAGUE, } TRUSTEES.

April 30, 1867.	The Property of this Fund on date consists of 10 New York Central Railroad Bonds, Nos. 19, 59, 65, 66, 67, 68, 69, 70, 71 and 72, @ $1000 each. Interest six per cent., payable semi-annually	$10,000.00

The Treasurer stated that on the previous day, Mr. Pope's bequest of $20,000 (less the amount of legacy tax $1,200) had been paid over to him, making the present net value of our property $313,253.41.

Upon his motion the following Resolution was passed: —

Resolved, That while gratefully acknowledging the receipt of the bequest of the late Paschal P. Pope, we desire also to express our thanks to the executors, Messrs. W. H. Boardman, and J. D. Farnsworth, for the promptness with which the amount has been paid over to the Society.

Resolved, That the Secretary be requested to send a copy of the foregoing resolve to the Executors.

The Treasurer, on behalf of the Auditing Committee, stated that the account of the Treasurer and Trustees had been carefully examined by them and found correctly cast and properly vouched, and that they had signed statements to that effect upon the books.

The Prize Committee stated that no competitors had appeared for the annual prizes.

The Nominating Committee reported a list of officers for the ensuing year; the election was then held, and the following gentlemen were declared elected;

PRESIDENT,
JEFFRIES WYMAN, M.D.

VICE-PRESIDENTS,
CHARLES T. JACKSON, M.D., THOMAS T. BOUVÉ.

CORRESPONDING SECRETARY,
SAMUEL L. ABBOT, M.D

RECORDING SECRETARY,
SAMUEL H. SCUDDER.

TREASURER,
EDWARD PICKERING.

LIBRARIAN,
SAMUEL H. SCUDDER.

CUSTODIAN,
SAMUEL H. SCUDDER.

CURATORS:

THOMAS T. BOUVÉ,	MINERALOGY.
THOMAS M. BREWER, M.D.,	ORNITHOLOGY; (NESTS AND EGGS).
JAMES C. WHITE, M.D.,	MAMMALOGY AND COMP. ANATOMY.
SAMUEL H. SCUDDER,	ENTOMOLOGY.
FRED. W. PUTNAM,	ICHTHYOLOGY.
B. JOY JEFFRIES, M.D.,	MICROSCOPY.
ALPHEUS HYATT,	PALÆONTOLOGY.
A. S. PACKARD, JR., M.D.,	CRUSTACEA.
ADDISON E. VERRILL,	RADIATA.
HORACE MANN,	BOTANY.
BURT G. WILDER, M. D.,	HERPETOLOGY.
WILLIAM T. BRIGHAM,	GEOLOGY.
J. ELLIOT CABOT,	ORNITHOLOGY.
EDWARD S. MORSE,	CONCHOLOGY.

Dr. Jeffries Wyman, on behalf of the Committee appointed to prepare an account of the life and scientific career of the late Dr. A. A. Gould, read the following notice: —

Augustus Addison Gould was born in New Ipswich, New Hampshire, on the 23d of April, 1805, among the high hills and under the shade of one more prominent than the rest, which helped to form what he calls the amphitheatre that surrounds the town. His early life was passed there, and as soon as he was old and strong enough to labor the larger part of the year was given to his father's farm, and the rest to the common school. At the age of fifteen he took the whole charge of the farm; nevertheless a part of the year was devoted to study, and some progress was made in the classics. By the careful husbanding of the odds and ends of time and a year's teaching at an academy, he was prepared to enter college, and entered at Cambridge in 1821. With his college life came a struggle, the forerunner of many such by which his strength was to be tried. He had already come to know something of the barrier which limited means had put between himself and the things he aspired to, and now this assumed larger proportions, such as to most persons would have been disheartening. College duties and exercises demanded his time, nevertheless his education must be paid for, and he must do largely towards earning the means; and so by strict economy, by performing various duties for which indigent students received compensation, and also by hard work in vacations and on those days which others gave to relaxation, he says he at length fought his way through, and attained to respectable rank.

In college he was noted among his classmates for industry, and it was there, too, that his taste for natural history began to show itself. He became familiar with the most of our native plants and to the end of life never lost his love for them. After leaving college, he held the office of private tutor in Maryland, and at the same time began the study of medicine. The rest of his pupilage was passed in Boston, and the last year of it at the Massachusetts General Hospital as house student. He was graduated in medicine in 1830, and at once began the practice of his profession, having given good grounds to his friends for expecting future eminence. But his struggles with poverty were not yet ended. Until his profession could yield him a support, he must go out of it, and did, to earn the necessaries of life. To this end he undertook burdensome tasks; one of them, the cataloguing and classification of the fifty thousand pamphlets in the library of the Boston Athenæum, was Herculean, as any one may see who will take the trouble to look over the four large folio volumes he wrote out, monuments of his patient industry and handiwork, and for which he got only a pitiful return.

The study of natural history was nearer to his heart than all other pursuits, and to that he could always turn, and did, whenever he could command a few spare hours or moments to do so. As a matter of course, he became a member of this Society. This was soon after its organization, and to the time he died, he labored for us without stint. When his studies began to assume a methodical shape, his first investigations were in the class of insects, of which, at one time, he had a large collection. Among his first published works was a monograph on the Cicindelæ of Massachusetts, printed in 1834, and in 1840 he published an account of the American species of shells belonging to the genus Pupa, in regard to which he found much confusion. These shells are very small, and Mr. Say, who named all the species previously described, gave no figures, and consequently naturalists fell into error. "I have received from our best conchologists," Dr. Gould says, "a single species under four of the names that Mr. Say applied to as many different species." Dr. Gould then points out how, by the use of the microscope, and a careful study of their minuter details, the classification of them might be improved. This paper was illustrated by about thirty figures carefully drawn by himself, with the aid of the microscope.

In 1841, he read before this Society a paper entitled "Results of an examination of the species of shells of Massachusetts, and of their Geographical Distribution." This is the more noteworthy since the geographical distribution of animals had at that time attracted but little attention, and none amongst us. Now it involves one of the most important zoölogical problems. From his examination it appeared that of the shells found within the borders of the State, forty-two were of land or fresh water, and two hundred and three of marine origin. While some of the marine species are found on the transatlantic shores, he thought that all the fresh water or land species were imported. Animals found in territories widely separated by salt water, appear to have been created distinct, and ever remain so, unless mingled by design or accidental transfer.

Dr. Gould also points out in this paper the influence of shore outlines, and shows from a comparison of species, that Cape Cod, which stretches out into the sea in a curved direction some forty or fifty miles, forms to some species an impassable barrier. Of two hundred and three species, eighty do not pass to the south, and thirty have not been found to the north. In the same paper he calls attention to the importance of the fact that certain species appear and disappear suddenly, and of the necessity, in order to construct a correct catalogue of the shells of any region, to extend observations through a series of years, a consideration which many naturalists, even of the present day, might profit by. In the spring of 1830, *Osteodesmus* was strewed upon Chelsea Beach in great number, and of very large size, but had never been observed there before, and has scarcely been seen since. *Cyprina Icelandica*, *Solemya velum*, *Varenius gemma* and *Margarita arctica*, also present instances of periodicity at long intervals. During the winter of 1838–39, *Nucula thraciæformis* was frequently found in the stomachs of the sand-dab, but search for them since has been almost fruitless.

One of the first results of the joint action of the members of this Society, and of which it has more reason to be proud than any other, was the part taken by some of them in the series of admirable reports on the natural history of the State, presented to the General Court in compliance with a legislative enactment. The report on the Trees was by Mr. George B. Emerson, then President of the Society, on Fishes, by Dr. D. H. Storer, on Insects Injurious to Vegetation, by Dr. T. W. Harris, and on the Invertebrate Animals, excepting insects, by Dr. Gould. They at once gained for their authors wide-spread reputation.

The Molluscs were Dr. Gould's favorite subjects for study, and his attention was chiefly given to them. Up to this time, few if any attempts had been made to give as complete a zoölogical survey as practicable of any particular region of the United States. As regards the Molluscs, the descriptions of Say, Conrad and others, pioneers in conchology, pertained more to the Middle and Western States, than to New England. Their writings were fragmentary and scattered through the narratives of travels, journals of science, and even newspapers. It was no small labor, therefore, to become acquainted, merely as a preparation for his task, with the writings of his predecessors. To make his report as complete as possible, and to ascertain what changes in the classification of Molluscs recent important progress growing out of the study of them would indicate, he opened correspondence for information and exchanges with European naturalists interested in the same branch of study, who obligingly and courteously lent their aid, and out of this correspondence grew up long continued friendships.

The report fills a volume of nearly four hundred pages, illustrated by more than two hundred figures skilfully drawn from nature by himself. "Every species described," he says, "indeed, almost every species mentioned, has passed under my own eye. The descriptions of species previously known, have been written anew, partly that they might be more minute in particulars, and partly with the hope of using language somewhat less technical than is ordinarily employed by scientific men." The number of species described was about two hundred and seventy-five of Molluscs and nearly one hundred of Crustaceans and Radiates.

As a contribution to zoölogical science, this report gave him an honorable name among the the naturalists of Europe and America, and so he attained to eminence.

Dr. Gould edited the admirable work entitled "The Terrestrial Air-breathing Molluscs of the United States," prepared, but left unfinished at the time of his death, by his intimate friend, Dr. Amos Binney, formerly the respected president of this Society, and whose name we hold in grateful remembrance, not only for his contributions to science, but for the munificent bequest which fills so large a space on the shelves of our library.

The plan of this work was broad and philosophical, passing far out of the region of generic and specific technicalities into the wider subjects of the principles of classification, of the geographical distribution of genera and species, and the causes influencing it, of zoölogical foci or points of origin, geological relations, habits, faculties and anatomical structure. Its incomplete state, the fact that many of the species collected by Dr. Binney in the southwestern States and Texas, had not been described by him up to the time of his death, and the changes made by more recent observations rendered the editorship of this work no sinecure. No one could be found more fit for the task, or more worthy to bring before the world the labors of a deceased friend.

In 1848 he was associated with Prof. Agassiz in the preparation of the Principles of Zöology.

His largest and most important contribution to natural history was the description of the shells of the United States Exploring Expedition. This was prepared under circumstances somewhat embarrassing. The collection was not made by himself, but by the late Capt. James P. Couthouy, well remembered as one of the most zealous and active members of this Society. Capt. Couthouy had drawn up full notes on the external characters of the soft parts, habits, geographical distribution, and on other important points. Before the voyage was completed he left the expedition, but the notes and collections were sent to Washington. The former were unaccountably lost, and no trace of them was found. The collections, when they came into the hands of the Navy Department, were repacked by incompetent hands, the arrangement of them disturbed, labels in many cases lost, and the whole thrown more or less into confusion. Dr. Gould was called upon to save the wreck, but in accepting the task was obliged to submit to various arbitrary restrictions, and to leave undone many things he deemed of much importance. Fully appreciating the value of a knowledge of the internal structure of the animals, and knowing too well the folly of attempting to find all the characters for a zoölogical description in the shell alone, he expresses his regret at the outset that full dissections and delineations of the internal features had not been directed or allowed. This was all the more to be regretted, since there was a great abundance of material for the required investigations.

Agreeably to his instructions, the work is almost wholly confined to generic and specific descriptions. In the introduction, however, he presents several generalizations of importance. By a careful comparison, he shows that Mollusca are confined generally to definite districts or areas. Descriptive writers have frequently given support to opposite views, and have fallen into error from not having taken proper care to ascertain the locality from which certain species came, a determination which is now considered of such prime importance. Shells purchased in the Hawaiian Islands are described as denizens of these islands, notwithstanding they may have been carried there from far off places. New England shells which have been sent to the western coast of America, have been known to come back in the way of exchanges, as natives of the Pacific shores. Errors have also been committed by attempting to decide the identity of species from distant places, by the shell alone, when observation has proved this in many cases impossible. When such, and other sources of error, are eliminated, the number of apparently identical species from widely different sources rapidly diminishes. In fact the doctrine of the local limitation of animals meets with so few exceptions, that we admit it as an axiom in zoölogy, he says, that species resembling one another from widely diverse localities, especially if a continent intervenes, and if no plausible means of communication can be assigned, are different until their identity can be proved. It is true that some species are more or less cosmopolite, as the Cypreas, and as at present understood, do not appear to be limited by seas, while others become cosmopolite by transportation, as certain Helices, which attach themselves to the water-casks of ships, and thus are carried around the world.

Another general consideration, and closely related to geographical distribution, grows out of the fact that the shells from definite regions have peculiarities of external form and color, of what may be called style, just as have the human races from different parts of the world. Thus, he says, we distinguish the loose, colorless structure of the northern species, the stony, corroded and livid New Zealanders, and the polished and absolutely perfect specimens from the coral seas.

Another generalization illustrated by the ample stores of the Expedition, is the occurrence of analogous species in coordinate regions, though the species themselves are absolutely distinct; in confirmation of which he gives a list of some thirty-two species found on the eastern and western coasts of the United States.

Lastly, it is shown by a careful comparison of the land shells of the Pacific islands, how one is helped in drawing inferences as to the lands which once occupied the area of the Pacific, and how, in consequence of their submergence, their mountain peaks, which now alone project above the surface of the water, constitute these islands. The Samoa and Friendly Islands give evidence of such relation in having identical species.

The Otia Conchologica was the last of his printed volumes, but this was merely a reprint in a condensed form of the descriptions of species of shells previously published separately in different works. Besides the works already mentioned, there is a long catalogue of communications made to the Boston Society of Natural History, and which is appended to this notice, which may be referred to as showing that he did not allow himself to become a mere specialist, but kept his mind awake to the relation of individual forms to higher and more general truths.

We must not forget that Dr. Gould was a member of the medical profession, and that his time was of necessity chiefly devoted to this, while the scientific labors we have been considering were the yield of spare moments made useful. He was an active member of the medical societies of this city and of the State, and held offices of trust in them. The Massachusetts Medical Society conferred on him the honors which it has to bestow upon its fellows. In 1855 he delivered the annual address, which was marked for the soundness of its views and the characteristic clearness and elegance with which they were presented. He took for his text the advice of Harvey to the Royal College of Physicians of London, when he founded the annual oration which bears his name, and in which, among other things, he enjoins upon the orator "an exhortation to the members to study and search out the secrets of nature by the way of experiment." Dr. Gould was elected president of the Society, and his term of office ended within a few months of his death. He was for several years one of the physicians of the Massachusetts General Hospital, was an efficient member of the Boston Society for Medical Improvement, where he often communicated valuable observations, and took an active part in its discussions. He labored much and long in preparing the vital statistics of the State from the official returns.

At one of the meetings of the National Academy of Sciences, of which he was a member, he presented an important paper on the distribution of certain diseases, especially consumption, in reference to the hygienic choice of a location for the cure of invalid soldiers. The census of 1860 gave the means of arriving at a definite result, and of showing that the mortality from the disease mentioned was greatest in the north, and diminished southwards almost as regularly as the States could be called. It causes about twenty-nine per cent.

of all the deaths in Maine, and only three per cent. of those in Arkansas. Infirmaries established with the idea of sending patients to those regions where the disease to be treated is presented in its mildest aspect, must be far more successful than the ordinary method of mingling together invalids suffering from all sorts of infirmities.

As a citizen, Dr. Gould made a principle of going out of the ordinary routine of life to lend a helping hand wherever it was desired and he could. He served the public in many capacities; in the religious society of which he was from early life a member, and in the public schools where he took an active interest in all attempts to improve the ways and means of instruction. He from time to time gave public lectures, and although in this capacity he could not be said to be brilliant or highly accomplished, yet his unostentatious manner and simplicity, his knowledge of his subject and hearty interest in it, always gained him attentive listeners, who went away instructed.

What can be said by way of acknowledgment of the unrequited work he did for us? of his services in the formation of the cabinet, and in promoting the interests of the Society in a hundred ways, above all in the drudgery which only ended with his life, his aid in preparing for the press and in superintending the publication of the various volumes printed by the Society, from the first to the last?

What has now been said relates only to some of the more tangible features of his principal works, leaving out of sight the industry, the critical acumen, the tact and perceptive power required to prepare them. This we can never appreciate, nor the difficulties under which his work was done. One could only do this by watching his patient studies in the intervals of professional calls, or as he labored at early dawn or late at night in the hours stolen from sleep. Though often an invalid, the sickness must have been irksome indeed, which could restrain him from his accustomed work.

In his temperament he was genial, and drew friends around him, retaining the old and attracting new. He came to the social gathering with joyous face and kindly feelings. His love for natural scenery was genuine and hearty, and whatever personal enjoyment came from this source, it was always enhanced if others partook of it with him. There are too many naturalists who stand in the presence of nature all their days, but see her not. To them the world offers nothing but the forms they would technically describe and arrange in their cabinets. Take away this object and all becomes a waste, for they are neither warmed nor enlivened by the world around them. Not so with our associate; no one toiled more industriously than he over individual forms and specific descriptions; but all this aside, every aspect of nature touched him to the innermost. Those who have been intimate with him know how his face would light up while in the presence of the least as well as of the greatest natural objects! the flower of a day, or the sturdy tree that had known its centuries of life, the quiet or the grander scenes of the world. His emotions were not those of an enthusiast, but rather came of a clear perception and calm contemplation of the things around him, and of his own responsive nature.

His life, all too poorly and inadequately represented in this sketch, was throughout a consistent one, and to the end each day was full to the round. He was still endeavoring to improve what had been done before, and looking forward to the accomplishment of new and better ends, when suddenly it was closed. He had been less well than usual; on the afternoon of September 14th, 1866, he manifested the usual symptoms of an attack of Asiatic cholera, soon after fell into a state of collapse, and on the following morning just before the dawn, he died.

For the following chronological catalogue of Dr. Gould's communications, I am indebted to Mr. Samuel H. Scudder, Secretary of the Society.

Lamarck's Genera of Shells with a Catalogue of Species. Translated from the French. . 16mo. Boston, 1833.

On the Cicindelæ of Massachusetts. Bost. Journ. of Nat. Hist., I. Art. iv, pp. 41–55, Plate 3.

Report on the Geology, Mineralogy, Botany and Zoölogy of Massachusetts, made and published by order of the government of that

State. 2d Edition, by Edward Hitchcock. 8vo. Amherst, 1835. Part IV. A Catalogue of the Animals and Plants in Massachusetts. vi., Crustacea, by A. A. G. pp. 548–50. Part IV. separately published. Crustacea, pp. 28–30.

First Report on the Geology of the State of Maine, by C. T. Jackson. 8vo. Augusta, 1837. List of shells found in Maine, by A. A. G. p. 119.

Reports of the Commissioners on the Zoölogical Survey of the State. Massachusetts House Documents, 1838, No. 72. Dr. Gould's Report (on molluscous and the other lower animals.) pp. 105–7.

Scientific Proceedings of the Boston Society of Natural History in the months of June, July and August, 1838; drawn up from the Records of the Society, by A. A. G., Recording Secretary. Amer. Journ. of Science and Arts. XXXVI; pp. 379–93, XXXVII; pp. 391–7.

Report on a paper by J. P. Couthouy on Thracia Conradi, with Rev. F. W. P. Greenwood. Amer. Journ. of Science and Arts. XXXVI; pp. 379–80.

On the marine product commonly called Neptune's Goblet. Amer. Journ. of Science and Arts. XXXVI; p. 386.

Remarks on Rostellaria occidentalis. Amer. Journ. of Science and Arts. XXXVII; p. 396.

On Dephinula minor. Amer. Journ. of Science and Arts. XXXVIII; p. 193.

Descriptions of Shells. Amer. Journ. of Science and Arts. XXXVIII; pp. 196–7. Otia Conchologica, pp. 179–81.

Report on shells from California. Amer. Journ. of Science and Arts. XXXVIII; p. 396.

On Scutella bifissa. Amer. Journ. of Science and Arts. XXXIX; p. 183.

Monograph of the Species of Pupa found in the United States; with figures. Bost. Journ. of Nat. Hist., III, Art. xiii, pp. 395–404, Plate III; IV, Art. xxviii, pp. 350–60, Plate XVI. Otia Conchologica, pp. 182–3.

Results of an Examination of the Shells of Massachusetts and their geographical distribution. Bost. Journ. of Nat. Hist., III, Art. xviii, pp. 483–94.

Report on the Invertebrata of Massachusetts, comprising the Mollusca, Crustacea, Annelida and Radiata. Published agreeably to an order of the Legislature, by the Commissioners on the Zoölogical and Botanical Survey of the State. 8vo. Cambridge, 1841. Otia Conchologica, pp. 181–2, 237. Annales des Sciences Naturelles, 2° Ser. T. XVI, p. 379. Amer. Journ. of Science and Arts. XLI; p. 378. Revue Zoologique, 1841. p. 282.

Results of investigations concerning the Testacea of Massachusetts. Proc. Bost. Soc. of Nat. Hist., I ; pp. 6, 7.

Notice of the origin, progress and present condition of the Boston Society of Natural History. Amer. Quart. Register, XIV ; pp. 236–41. Also published separately, pp. 1–8.

Characters of shells to be fully described in the next number of the Journal. Boston. Journ. of Nat. Hist., IV, third page of the cover of No. 1. Proc. Bost. Soc. of Nat. Hist., I ; pp. 137–8. Otia Conchologica, p. 183.

Review of Ellis's work on Corallines. Proc. Bost. Soc. of Nat. Hist., I ; p. 16.

Notice of Paludina ponderosa. Proc. Bost. Soc. of Nat. Hist., I ; p. 32.

Examination of a paper by Henry C. Lea, purporting to describe eight new species of shells. Proc. Bost. Soc. of Nat. Hist., I ; p. 61.

Remarks on the variations of a species of Neritina. Proc. Bost. Soc. of Nat. Hist., I ; p. 71.

On the powers of locomotion in Mytilus edulis. Proc. Bost. Soc. of Nat. Hist., I ; p. 72.

Notice of Sowerby's Thesaurus Conchyliorum, No. 1. Proc. Bost. Soc. of Nat. Hist., I ; p. 86.

Review of a pamphlet by Prof. C. B. Adams, on the Mollusca of Vermont. Proc. Bost. Soc. of Nat. Hist., I ; p. 89.

Description of Pasithoe umbonata. Proc. Bost. Soc. of Nat. Hist., I ; pp. 92–3.

Notice of some works recently published on the nomenclature of Zoölogy. Amer. Journ. of Science and Arts. XLV ; Art. i. pp. 1–12.

Remarks on Dr. Binney's critical notice of the species of the genus Pupa found in the United States. Proc. Bost. Soc. of Nat. Hist., I ; p. 106.

Notice of Mighel's Catalogue of the marine, fluviatile and terrestrial shells of the State of Maine and adjacent Ocean. Proc. Bost. Soc. of Nat. Hist., I ; pp. 117–8.

Notice of Haldeman's Monograph of the freshwater univalve Mollusca of the United States. Genus Physa. Proc. Bost. Soc. Nat. Hist., I ; pp. 132–3.

Review of characters of shells described on the cover of the Boston Journal of Natural History, Vol. IV., No. 1. Proc. Bost. Soc. Nat. Hist., I ; pp. 137–8. Otia Conchologica, p. 183.

Descriptions of two foreign species of Pupa. Proc. Bost. Soc. of Nat. Hist., I ; pp. 138–9. Otia Conchologica, p. 189.

Characterization of Shells appearing to be hitherto undescribed, received from the Rev. Francis Mason, missionary at Tavoy, British Burmah. Proc. Bost. Soc. of Nat. Hist., I ; pp. 139–41, 144. Otia

Conchologica, pp. 189–92. Mason's Burmah. pp. 371, 372, 374. Journ. Asiatic Soc. of Bengal, [n. s.,] No. 186, pp. 62–5.

Report on Papers of the Rev. R. T. Lowe, relating to the plants and land-shells of Madeira. Proc. Bost. Soc. Nat. Hist., I; pp. 148–9.

Remarks on some Shells received from Dr. Savage from Cape Palmas. Proc. Bost. Soc. Nat. Hist., I; p. 153.

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Descriptions of two species of Anodon from the River Salwen in British Burmah, sent by Rev. F. Mason. Proc. Bost. Soc. of Nat. Hist., I; pp. 160–1. Otia Conchologica, pp. 193–4. Mason's Burmah, p. 375.

Descriptions of Land Shells from the Province of Tavoy in British Burmah. Bost. Journ. of Nat. Hist., IV; Art. xxxviii, pp. 452–9, Plate xxiv. Otia Conchologica, pp. 183–4, 189–92. Mason's Burmah, pp. 371–2, 374. Journ. Asiatic Soc. of Bengal, [n. s.,] No. 186. pp. 62–5.

Descriptions and notices of some of the Land Shells of Cuba. Bost. Journ. of Nat. Hist., IV; Art. xli, pp. 485–98. Plate xxiv.

On Helix lucida. Proc. Bost. Soc. of Nat. Hist., I; p. 174.

Descriptions of two species of Helix from the Sandwich Islands. Proc. Bost. Soc. of Nat. Hist., I; p. 174. Otia Conchologica, p. 194.

Notice of a paper by Mr. I. Lea, describing shells supposed to be new. Proc. Bost. Soc. of Nat. Hist., I; pp. 183–4.

Remarks on Mighel's descriptions of shells. Proc. Bost. Soc. of Nat. Hist., I; p. 189.

Descriptions of species of Land Shells from the Sandwich Islands. Proc. Bost. Soc. of Nat. Hist., II; pp. 26–8. Otia Conchologica, pp. 194–6.

Descriptions of Shells collected by Dr. Charles J. Bates, on the Coast of Liberia. Proc. Bost. Soc. of Nat. Hist., II; pp. 37–8. Otia Conchologica, pp. 196–7.

Descriptions of recent Shells collected by Mr. John Bartlett in the Everglades of Florida. Proc. Bost. Soc. of Nat. Hist., II; p. 53. Otia Conchologica, p. 197.

Descriptions of Shells from the Coast of Africa. Bost. Journ. of Nat. Hist., V; Art. xix, pp. 290–3, Plate xxiv. Otia Conchologica, pp. 196–7.

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Description of Shells from Tavoy. Proc. Bost. Soc. of Nat. Hist., II; pp. 98–100. Otia Conchologica, pp. 198–9. Mason's Burmah, pp. 367, 370, 373.

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On the occurrence of Esox lucius in Connecticut River. Proc. Bost. Nat. Hist., II; p. 107.

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Note to description of two new species of Shells by William Case. Amer. Journ. of Science and Arts. [2] III; pp. 101, 276.

Description of new Shells received from Rev. Mr. Mason of Burmah. Proc. Bost. Soc. Nat. Hist., II; pp. 218–21. Otia Conchologica, pp. 200–201. Mason's Burmah, pp. 371, 374–5.

Remarks on Planorbis multivolvis. Proc. Bost. Soc. of Nat. Hist., II; p. 259.

Description of shells collected by Dr. C. T. Jackson on the shores of Lake Superior. Proc. Bost. Soc. of Nat. Hist., II; pp. 262–4 (wood cuts). Otia Conchologica, pp. 201–2.

On the experiments of Prof. Matteuci with reference to the phosphorescence of animals. Proc. Bost. Soc. Nat. Hist., III; p. 7.

On the occurrence of Bulla solitaria on Plymouth Beach. Proc. Bost. Soc. of Nat. Hist., III; p. 9.

Principles of Zoölogy, touching the structure, development, distribution and natural arrangement of the races of animals, living and extinct; with numerous illustrations. For the use of schools and colleges. Part I. Comparative Physiology, by L. Agassiz and A. A. G. 8vo. Boston, 1848. English Edition, revised by Th. Wright. 8vo. London, 1851. German Edition, 8vo. Stuttgart, 1851. 2d edition, 1855.

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Descriptions of Shells. Proc. Bost. Soc. of Nat. Hist., III; pp. 64–5. Otia Conchologica, pp. 205–6.

The Naturalist's Library, containing scientific and popular descriptions of Man, Quadrupeds, Birds, Fishes, Reptiles and Insects; compiled from the works of Cuvier, Griffith, Richardson, Geoffroy, Lacépède, Buffon, Goldsmith, Shaw, Montague, Wilson, Lewis and Clarke, Audubon and other writers on Natural History; arranged according to the classification of Stark, edited by A. A. G. With four hundred engravings. 8vo. Boston, 1849.

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Remarks on specimens of Lymnæa from Lake Superior. Proc. Bost. Soc. of Nat. Hist., III; p. 181.

On the occurrence of Helix hortensis of Europe, on an island near Cape Ann. Proc. Bost Soc. of Nat. Hist., III; p. 181.

Descriptions of new species of Shells from Africa, presented by Dr. Perkins. Proc. Bost. Soc. of Nat. Hist., III; pp. 193–7. Otia Conchologica, pp. 206–10.

Lake Superior, its Physical Character, Vegetation and Animals; compared with those of other and similar regions, by Louis Agassiz. 8vo. Boston, 1850. Art. V. Catalogue of Shells with descriptions of new species, by A. A. G. pp. 243–5.

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On the power of Arachnida to produce fertile eggs, though completely isolated from the male. Proc. Bost. Soc. of Nat. Hist., VI; p. 285.

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On the relations of genera to geographical distribution. Proc. Bost. Soc. Nat. Hist., VII; p. 167.

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On holes in stone, said by Prof. Agassiz to have been excavated by Saxicava rugosa. Proc. Bost. Soc. Nat. Hist., VIII; p. 105.

Description of new genera and species of shells. Proc. Bost. Soc. Nat. Hist., VIII; pp. 280–4. Otia Conchologica, pp. 237–41.

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Epitome of the Records of the Linnean Society of New England. Proc. Bost. Soc. Nat. Hist., IX; pp. 335–40.

Remarks on the diversity among Conchologists in the application of terms in the description of shells. Proc. Bost. Soc. Nat. Hist., X; pp. 77–8.

Dr. S. L. Abbot, on behalf of the Committee appointed to prepare an account of the life and scientific career of the late Dr. Henry Bryant, read the following notice: —

Dr. Henry Bryant was born in Boston, May 12th, 1820. He received his early education here at Mr. Thayer's school, and was prepared for college at Mr. Welles' school in Cambridge. He entered Harvard University in 1836 and graduated in 1840, and immediately commenced the study of medicine in the Tremont Medical School and the Medical School of the University, from the latter of which he received the degree of Doctor of Medicine in 1843. Soon afterwards he went to Europe to prosecute his professional studies still farther in Paris. Some time in the year 1845 he received the appointment of *Interne* in the Hospital Beaujon in Paris, an appointment specially honorable, as it is only obtainable as the result of a severe competitive examination. The close confinement and laborious duties of this office broke down his health, and he was in consequence obliged to resign his position a few months afterwards. Availing himself of an opportunity which was offered to him, through the kindness of some French army officers whose acquaintance he had made, and seeing in it a probable means of restoring his health, he joined the French army in Africa as a volunteer surgeon, and served in this capacity during a winter campaign in Algeria in 1846. It is probable that this experience, by fitting him for the responsible duties of an army surgeon, had an important influence in leading him to offer his services in this capacity at an early date during the recent war in this country.

From Europe Dr. Bryant returned home in October, 1847, and commenced the practice of his profession in Boston, associating himself with Dr. Henry J. Bigelow as surgeon to a private dispensary for surgical cases. In carrying out the plan of this arrangement he again made a trip to Europe, where he remained for a few months. Shortly after his return home his health again failed him, under his assiduous application to his duties, and he was finally obliged to abandon the practice of his profession; this he was enabled the more readily to do, as his circumstances in life were such as not to compel him to rely upon his profession for support.

Dr. Bryant was married January 6th, 1848, to Elizabeth B. Sohier, daughter of William D. Sohier, Esq., of Boston.

After giving up the practice of his profession, Dr. Bryant devoted himself with more or less assiduity to the study of Ornithology, which had been a favorite pursuit with him from boyhood. It was at about this period that Dr. Bryant met with a severe accident, causing alarming symptoms at the time, and, as he thought himself, having much to do with the subsequent attacks of indisposition from which he suffered very frequently to the close of his life. In landing from his boat at Cohasset his foot slipped on some wet seaweed and he fell with great violence upon a rock, receiving a severe blow in the region of the stomach. He was taken up insensible, and was confined to his bed for several weeks, suffering very severely. The precarious state of his health compelled him to take a great deal of out door exercise; and his active, energetic temperament led him often to the most distant parts of this country in excursions for the purpose of collecting specimens of ornithology and other objects of natural history; and on which he was often exposed to great hardship and privation, but which only seemed to invigorate him. He had a singular power of endurance, and, invalid as he was, a most stoical indifference to considerations of personal comfort on these expeditions. Thus he passed his time, partly at his summer residence at Cohasset in this State, partly at his house in Boston, at short intervals disappearing from sight for a few weeks or months, to return from the extreme north or south laden with the spoils of his campaign. Of late years he made quite frequent visits to the West India islands during the winter seasons, for the same purpose.

Subject to this necessity of prolonged excursions from home and an active life in the open air, the outbreak of the civil war in this country found him untrammelled by professional bonds, and prepared by a previous experience of army life to enter at once upon the arduous and responsible duties of an army surgeon. It was a time when the number of medical men thus qualified, in this country, was extremely small, and the demand for them was the most urgent. It was all the more honorable, therefore, to the subject of our notice, that, uninfluenced by any pecuniary necessity, and unstimulated by any professional ambition, with the leisure and opportunity of devoting his time in the pleasantest way to the delightful branch of natural history which he had made his special study, he yet felt it his duty to come forward early and offer his services to his country. Not content with the appointment which the necessity of the case or the influence of friends might easily have secured for him, he went to Washington and offered himself as a candidate for the office of assistant surgeon in the regular army. As might have been' anticipated the severe ordeal of examination to which he was subjected was no obstacle to him, and he returned home with the commission for which he had offered himself. Without waiting for the position which this appointment might give him in the regular army, which was then dwindling into insignificance in point of numbers in comparison with the volunteer host which was mustering, he accepted the appointment of Surgeon to the 20th regiment of Massachusetts volunteers, and was commissioned in that capacity, July 1st, 1861. He was promoted to be Brigade Surgeon, September 10th, but remained with his regiment until after the disaster of Ball's Bluff in October, when he joined General Lander in the Shenandoah valley, and served on his staff until the death of that officer. He next joined the command of General Shields in the same department, in the capacity of Medical Director. While engaged in this service he received a severe injury of the knee from his horse falling with him on icy ground. From this accident he suffered many months, part of the time being confined to his bed in extreme pain, and much of this period being unable to set his foot to the ground. His injury was so severe that the question of amputation was at one time entertained; yet during the whole of this term of service he continued on duty and did not ask for leave of absence until his convalescence was fully established. It was while suffering in this way that he organized the military hospitals in Winchester in addition to his other arduous duties. He accompanied General Shields' command to Fredericksburg in August, 1862, and in the same month was ordered to take charge of a small military hospital near Washington, known as Cliffburn hospital. Having thoroughly organized it, and put it in successful operation, he left it, by orders from Government, for Washington, December 23d, 1862, where he took charge, on the 30th, of the Lincoln Hospital, one of the first of the large army hospitals, at a time when the elaborate system under which so many were subsequently planned and put in operation by the Medical Department of the army was as yet in embryo. Upon him individually, therefore, rested the whole labor of planning and putting into execution the multitude of details involved in so responsible an experiment. That his efforts were crowned with the most complete success is the verdict of every medical man who had an opportunity of visiting his well-ordered establishment. In fact the Lincoln Hospital under his administration was regarded as a model hospital. But here, as on every occasion before, where he had been exposed to the exhaustion attendant upon close confinement and excessive mental labor, his strength and health failed him, and finally, completely broken down, he was compelled to throw up his commission and resign his place in the army in the month of May.

A characteristic extract from a letter to a friend, dated

May 1st, 1863, shows his determined spirit, and to what an extremity his indisposition had brought him. He writes: —

> "I am as nearly dead as a man can be without stopping his breath. I have not touched a morsel of food for seventy-two hours; and for the week previous did not eat more than three ounces a day. I can not at times drink a mouthful of cold water without suffering excruciating pain. I am so weak that I can hardly stand, but I have to work all the time. If I don't get better shortly I shall leave and let everything go."

After the establishment of peace in this country, he visited Europe once more, accompanied by his family, whom he left there after a few months, returning to this country *en route* of another ornithological excursion to the warmer latitudes of North America. Again he crossed to Europe, and again returned to Boston towards the close of 1866. He sailed for Porto Rico, December 1st, and arrived there on the 9th, intending to proceed to St. Thomas, but which he was deterred from doing by the reports of the prevalence of cholera and yellow fever in that island. He remained, therefore, at Porto Rico, and on the 28th of January, 1867, after travelling in the island, he reached Utuado. On the 29th he shot for an hour or two in the afternoon in this mountainous region without fatigue and slept well. On the 30th he was taken sick with what he regarded as rheumatism, suffering excruciating pain in his back and limbs. According to the statement of his companion, his pain was such as to compel him to leave the house and walk the street to relieve his intolerable restlessness; a circumstance which indicates that his suffering must have been very great, as he had, on ordinary occasions, an uncommon power of endurance and self-control. A large dose of opium quieted him at last, and he passed a comfortable night. On the 1st of February, finding that his symptoms were no better, he determined to go to Araceibo, a distance of twenty-five miles, on horseback. His pain was excessive, but at ten o'clock he and his companion mounted their horses and rode until one. Although suffering intensely, with characteristic energy he dismounted at a bridge at one o'clock for the purpose of shooting some swallows which were flying over the river, and fired twice.

From that point to Araccibo, a distance of eight miles, he was compelled to walk most of the way, being unable to bear the motion of riding. The following night he slept well, having taken a glass of whiskey and water and a heavy dose of opium at bed time. He had proposed starting in a carriage for St. John, a distance of fifty miles, on the following morning. On being called by his companion at six and a half o'clock he inquired what time it was and said he felt better. He then asked to be called at seven, as he did not wish to rise then. At seven a druggist came in to learn how to skin a bird, Dr. Bryant having promised to teach him. At first he declined for want of time, but afterwards sent for a bird skin and explained the process. At ten minutes past seven he rose and dressed, came out of his chamber and took some coffee, but seemed stupid and heavy, and returned to his chamber, asking his companion to get his luggage ready. At half past seven the coach came, the trunks were put on, and he was called but did not answer. On going to his room he was found in a state of unconsciousness from which all attempts at arousing him were unavailable. His symptoms pointed to the brain as the seat of some grave disease, and he received the most assiduous attention of his physicians until he died, which event took place at a quarter past four, P. M.

This brief history of the life and death of our departed associate is all which the Committee have been enabled to prepare. The absence of all of his nearest relatives from the country deprives them of the opportunity of giving many details which they would have been glad to have presented. Enough has been said, however, to show that Dr. Bryant was a man of no common kind. To many of his acquaintances, however, he was, in some respects, an insoluble problem. He was regarded by most people as somewhat peculiar and eccentric, and the Committee feel it their duty, therefore, to dwell a little upon certain points in his character which were not generally well understood.

He was well known to a large number of persons, in the sense that certain traits and peculiarities of his were familiar to them. But these peculiarities, in the judgment of those who knew him best, rather concealed than showed his real character. For instance, he was often very communicative, extremely free in his mode of address, even with strangers or persons entitled by age or station to superior respect; and probably seemed to most people exceedingly free and easy and demonstrative. At the same time, perhaps his strongest characteristic was reserve; a reserve so deep-seated and habitual that even the familiarity of years, and entire mutual confidence did not do much towards really removing it, even after it had ceased to be a concealment. His repugnance to speaking of matters which touched him closely, though there might be nothing in them that he wished in the least to conceal, was remarkable, and stood in strange contrast with the extreme irreverence and the off-hand way in which he handled any topics of only general interest. This reserve was not always passive merely or silent, but aggressive, and showed itself in banter and mystification, and in an assumed cynicism, which formed much of the surface he showed to the world. Beneath this, the real man was of an almost childlike simplicity and affectionateness, and of an integrity that revealed itself in naive astonishment when he found the disbelief in unselfish motives which he so often professed, really acted upon by another. The key to much that was puzzling in him is to be sought in the combination of quick and even overquick perception, and a lively, impatient disposition (lacking at the same time all heat of temper), with an utter want of that *social conscience*, that mastering sense of what is usual and what is expected, which makes better citizens sometimes of persons far more scantily provided by nature than he. The absence of it saved him no doubt from many snares that beset most men's paths, but he missed with it the useful effect of the old ruts of convention in utilizing energy and in supplying a ready-made guidance always at hand, and at any rate much better than none. Dr. Bryant said of himself that his great defect was too much quickness. What he needed was to run weighted and between fences. Wanting these external helps, driven by his vivacious temperament, impatient of inaction and still more impatient of routine, his energies found no suitable outlet in steady work, but escaped in an irregular and fitful way, in self-appointed tasks, shrewdly planned and admirably executed, so far as they were executed at all, but undertaken, avoided, or dropped rather as whim or chance might dictate, than of any settled purpose.

Ill-health had, no doubt, much to do with this. But the waste of force was aggravated by something deeper than mere bodily disturbances. His insufficiently balanced energy made him hard to please with any attainable results of his own or others, not from censoriousness, for there was not a grain of malice or sourness in him, but with the necessary effect, often, to leave him to take up with something inferior merely as less inviting attack.

He dearly loved thoroughness, and insisted upon it in all that he did or directed, and in himself or in others could more easily tolerate omission than slack performance. His acute logical intellect took nothing for granted and received nothing upon hearsay or second-hand assurance. This love of exactness, however, was no love of quiddling, but he looked always to substantials, and readily seized the point of real importance. Hence it was, no doubt, that with all his tenacity of purpose he always gained and kept the respect and attachment of those with whom he had to do, for they felt that it had in it nothing of fussiness or self-importance, but came only from an uncompromising adherence to a really elevated standard. He was true as steel, through and through genuine, and with far more kindliness and far wider comprehensiveness and sympathy than he ever liked to show.

In his dealings with others, his intellectual honesty and clearness of sight, his horror of fallacies and conventionalities, together with his recklessness of appearances and of consequences made him impatient of any suspension of judgment, and needlessly intolerant of those *buffers* of sentiment which between most people ease off the shocks that human infirmities render inevitable. He must go straight to the end that happened at the moment to be before him, and the consequence was a certain want of poise and of breadth of view. Upon these obstructions he wasted too much of his strength; and though he made his mark and lived not in vain, yet now only his friends can know what possibilities lay in him, and how superficial were the hindrances that prevented them from being fully realized. They alone can know the real elevation of purpose and the real humanity that were often hidden from the eyes of the world under an assumed air of carelessness or of cynicism.

Dr. Bryant was elected a member of the Society November, 1841, and appointed cabinet-keeper at the annual meeting in 1843, but resigned November 1st of the same year. In 1854 he was elected Curator of Ornithology, which office he filled until his death. In 1855 he also took charge of the Entomological collection for a time.

During his connection with the Society he read the following Communications and Papers, which were published by the Society.

1853. *February* 3. A paper on the non-identity of *Grus canadensis* and *Grus americana*.

1857. *January* 21. On the birds observed at Grand Manan and at Yarmouth, N. S., from June 16th to July 8th, 1856.

March 4. Communication on the supposed new species of Turkey from Mexico, described by Mr. Gould.

1859. *January* 19. On birds observed by him in East Florida, south of St. Augustine.

July 6. A list of birds seen at the Bahamas from January 20th to May 14th, 1859, with descriptions of new or little-known species.

1860. *January* 18. A Paper on *Turdus minimus* and *Vireo bogotensis*, from Bogota.

1861. *January* 16. Remarks on some of the birds that breed in the Gulf of St. Lawrence.

March 6. Remarks on the variations of plumage in *Buteo borealis* Auct., and *Buteo Harlani* Auct.

March 20. Monograph on the Genus *Catarractes* Moehring.

1863. *July* 1. Description of two birds from the Bahama Islands, hitherto undescribed; *Pitangus bahamensis* and *Saurothera bahamensis*.

December 16. Description of a new variety of *Parus* from Yarmouth, N. S.; also Remarks on the Genus *Galeoscoptes* Cabanis, with the characters of two new genera, and a description of *Turdus plumbeus* Linn.

1865. *January* 4. Remarks on the type of *Buteo insignatus*; also Remarks on *Sphyropicus varius* Linn.

1866. *January* 3. A list of birds from Porto Rico presented to the Smithsonian Institution by Messrs. Robert Swift and George Latimer, with descriptions of new species and varieties.

October 17. Addition to a list of birds seen at the Bahamas.

December 5. A list of the birds of St. Domingo with descriptions of some new species or varieties.

Dr. Bryant also published in the Comptes Rendus, XXVI, p. 276, 1848, a paper on the Corpus striatum in birds.

During the last ten years he made the following expeditions for scientific research and collections, viz.: To Grand Manan, Florida, Bahamas, Florida, Canada and Labrador, North Carolina, Cuba, Jamaica, Bahamas, Porto Rico.

His Donations to the Society are as follows:—

1859. A collection of reptiles, fishes, crustaceans and shells from the Bahamas.

1860. Miscellaneous collections from Labrador and Florida.

1861. A valuable collection of skins of mammals procured by him through the Smithsonian Institution.

1864. Three hundred mounted foreign birds from his own collection, and three hundred and forty-six specimens of mounted birds obtained by him from the Smithsonian Institution; the specimens from this Institution, in the last two donations, having been procured through pecuniary aid received from him.

1865. Twenty-five hundred specimens, chiefly shells and insects. Five hundred specimens of fossils from Lyme Regis.

1866. The magnificent Lafresnaye collection of birds, containing nearly nine thousand specimens, was purchased by him at Falaise, France, and presented to the Society. Of this addition to the Museum, Prof. Baird, in a letter to the Committee, writes as follows:—"I have little hesitation in saying that no other single cabinet in Europe, public or private, contains so many types of American species, and could I have chosen at will, I certainly would have selected that in your possession as the most desirable to have in America. This is due to the fact that Lafresnaye, during the many years in which he was occupied in forming his collection, was the principal authority for South American ornithology; and nearly all the principal gatherings from Bogota, Ecuador, Bolivia, etc., passed into his hands for description, and either by purchase or donation he retained for himself types of his species."

Mr. T. T. Bouvé offered the following remarks:—

Mineralogists are well acquainted with the occurrence of Cinnamon Stone and Pyroxene and sometimes of Cinnamon Stone, Pyroxene and Idocrase together in various localities of New England, particularly in those of Amherst, N. H., and Phippsburg, Maine, from which places many fine specimens have been procured which adorn their cabinets.

I am happy in being able to announce another interesting locality of the same minerals; Cinnamon Stone, Pyroxene and Idocrase occurring together in Warren, N. H., a few miles from the Tremolite vein, which is well known for the interesting combination of Sulphurets of Iron, Copper, Lead, and Cadmiferous Zinc which it contains. The specimens which I exhibit and which have been obtained for the Society by exchange with Mr. M. Woolson, a gentleman of Concord much interested in scientific pursuits, will give you some idea of the interesting character of the discovery. The garnets fully equal, and perhaps surpass, any that have been found in this country, approaching in beauty those of St. Gothard.

The Idocrase is of brown color similar to that found at Amherst. The Pyroxene is well crystallized and of a fine green color.

Cinnamon Stone Garnet or Essonite is, as you are aware, a silicate of Alumina and Lime. Idocrase has the same composition. Pyroxene is also a silicate, with Lime as one of its bases. All are silicates containing Lime; and Dr. Jackson remarks, in his report upon the Geology of New Hampshire, that the occurrence of these species together at the junction of the limestone with the primary rocks, sufficiently indicates their igneous origin, since we know that just such series have resulted from igneous agency elsewhere. Associated with these minerals at Phippsburg, Dr. Jackson and Mr. Alger discovered, many years since, a few specimens of the rare mineral Axinite, presenting the same crystallization as that of Dauphiny. I would suggest, therefore, to those who may visit the new locality of Cinnamon Stone at Warren, as also to such as may obtain specimens from the other localities where Cinnamon Stone and the other associated species occur, to look for Axinite. It would be strange indeed, if the few specimens obtained by Dr. Jackson and Mr. Alger, and which the former gentleman now has in his cabinet, should be all that were found.

Other localities of Cinnamon Stone and associated minerals in New England, are, Parsonfield and Rumford, Maine, and Carlisle and Boxborough, Mass.

The Pyroxene is in some cases of the variety Sahlite, and in some instances Pargasite and Scapolite accompany the other named minerals. At Amherst the crystals of Cinnamon Stone and Idocrase occur imbedded both in Limestone and Quartz, and it is noticeable that those of the Quartz are much superior to the others.

Dr. C. T. Jackson read the following description of a new mineral, Stetefeldtite, by Mr. Eugene N. Riotte of Austin, Nevada:—

Allow me through your Society to make known to the scientific world, a new mineral lately discovered by me, which I beg leave to name "Stetefeldtite." Specimens of the same will accompany this paper. I would here return thanks to Messrs. Stoddar and Stetefeldt for their aid in procuring in this wilderness, the following data, by which I hope to be able to prove to your satisfaction, the existence of a new species of mineral, the knowledge of the composition of which, on account of its general occurrence in the southeast portion of this State, and its great value in silver, will certainly be of great importance to science and practice.

The specimen sent and studied will be but one of a series in an order of minerals, as for instance every specimen of fahlerz illustrates but a subspecies of the *tetrahedrite* family.

The extremes of this Stetefeldtite could be designated by the formulas

$$2\ Cu' + R^3O\ Sb^2\ O^5 + 6\ HO$$

and

$$2\ Ag' + R^3O\ Sb^2\ O^5 + 6\ HO.$$

the chief diversity occurring as to the amount of silver. RO would consist of variable quantities of $Cu'O$, feO and PbO, the latter seldom. The most common mean would be a mineral containing about one-half as much silver as the Ag' extreme.

As extrême values for Ag', I have obtained from different localities 2 per cent. and 24 per cent., so that my notion of a species of mineral is based upon investigation.

Taking all these facts into consideration, I would describe it mineralogically as follows:

Stetefeldtite. Massive, structure compact and even. H = 3.5 to 4.5. G. = 4.2. Limits 4.12 and 4.24 in four determinations. Lustre dull slate like. Color, slate black, with an occasional blue and brown tinge. Streak dirty yellow green. In the streak the mineral becomes shining, as also by rubbing with a hard substance. Fracture uneven, sometimes conchoidal. Brittle to soft, only in the streak a little malleable.

Composition. Two full analyses and several tests give for the specimens sent:

Found.	Calculated.
Ag=23.74.	Ag=23.23.
fe=1.82=feO=2.34.	feO=2.41.
S=4.7.	S=4.59.
Cu=12.78 Cu=2.32. CuO=13.08.	CuO=13.28.
SbO^5 SbO^3=43.77 SbO^5=46.03.	SbO^5=46.47.
HO=7.9.	HO=7.75.
	100.00.

B. B. fuses easily, soon affording a globule of silver and copper, and an intensely red colored slag. Upon very careful and strong reduction on coal gives fumes of SbO^3. In glass beads gives reactions for copper, but even very small quantities make the beads opaque.

Plan of Analysis. The mineral was dissolved in concentrated fuming NO^5, and boiled till most of the surplus acid was gone. Then diluted with water till no more SbO^5 was precipitated, filtered and the antimony determined as SbO^5 SbO^3 by heating and burning the filter with HgO; from the solution the Ag was precipitated by HCl. filtered; then the SO^3 was precipitated by BaCl. filtered. Then the Cu, precipitated in the first case with SH and in the second (after getting rid of the surplus BaCl. by SO^3 and precipitating the fe with ammonia) by precipitation with KO.

Water was determined repeatedly by heating in a closed tube (after drying at a temperature of 100°) and weighing until the weight did not decrease. Thus from 6.5 per cent. to 8 per cent. were found, agreeing in the average very well with the rest of the analysis. A direct assay for water by means of a chlorcalcium tube as described by Bunsen, made by Mr. C. A. Stetefeldt, gave nearly 10 per cent. of water, but as all articles required could not be obtained here, he thinks the difference can be accounted for. Sulphur was determined thrice with limits from 4.5 per cent. to 4.77 per cent., the third being the determination in the last analysis giving 4.7 per cent.

If solved in Aqua Regia the insoluble precipitate is composed of AgCl. and SbO^5.

The next question which arises from the analysis is, how are the elements grouped in the mineral?

The silver is evidently combined with the sulphur. A direct test made to determine this, proved it. The silver is easily reduced in a glass tube if heated steam is passed over the mineral; at the same time HS is emitted. Pieces of the Stetefeldtite show the reduction by becoming covered with silver wires. The fact that neither silver nor any of the noble metals ever occur as oxides, nor as such in salts (problematical), carbonate of silver excepted, speaks against any supposition of its being contained in an oxydized state.

The most natural grouping of the elements in proportion, as the analysis gives them, is shown in the following formula:

$$5R'+R^7OSb^3O^5+15HO.$$

This gives the value as found by the analysis exactly.

A formula reading as follows:

$$2R'+R^3OSb^2O^5+6HO$$

would be tolerably accurate and fall within the limits of error in the analysis.

In either case R′ would denote $\frac{3}{4}$ Ag′ + $\frac{1}{4}$ Cu′ and RO would denote $\frac{5}{6}$ CuO + $\frac{1}{6}$ feO.

This composition is truly remarkable and an analogy can hardly be found. It seems as though all the extraordinary peculiarities of several minerals were joined in this. We have a sulphuret, combined with an oxygen salt, as in the Helvin, and an antimoniate as a hydrate, as in the case of the bleinierite. Perhaps an analogy can be found by comparing the formulas of apatite, pyromorphite and bleinierite.

The question has arisen, whether this substance was not the product of decomposition from tetrahedrite. If it is, the decomposition has certainly produced a new and characteristic mineral, and often produces it even in very different localities. But the fact that the mineral is often found enclosed in solid hard quartz with sharp outlines and bordering, without any discoloration whatever from the carbonates of copper, speaks evidently for a kind at least of originality. The mineral has been found in the upper levels of mines, decomposed so as to form flakes of chloride of silver, azurite and malachite, and sometimes a yellow film of antimoniate of lead.

The finest specimens, masses three and four inches in diameter, come from the Empire District, 130 miles southeast from Austin. The specimen sent comes from there. I hope to be able in a few weeks to forward very superior pieces (if the snow blockade is raised).

I have also found beautiful masses in the High-bridge and Silver Chord ledges, in the Philadelphia District, 100 miles southeast from here. Eureka furnishes a variety with lead and but 3 to 4 per cent. of silver. Zone and Palmetto, as well as the Northumberland District furnish some with from 20 to 25 per cent. of silver.

Messrs. Robert Williams, Lucas Baker and James L. Little of Boston, and Mr. John G. Anthony of Cambridge, were elected Resident Members.

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Der Blüthenstand der Juncaceen. Von Dr. Franz Buchenau zu Bremen. 8vo. Pamph. 1865. *From the Author.*

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Notes on the Zygænidæ of Cuba. By A. R. Grote. Parts I–II. 8vo. Philadelphia, 1866–7. *From the Author.*

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Observations upon the Cranial Forms of the American Aborigines, based upon specimens contained in the Collection of the Academy of Natural Sciences of Philadelphia. By J. Aitken Meigs, M. D. 8vo. Pamph. Philadelphia, 1866. *From the Author.*

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Proceedings of the American Pomological Society. 3d, 6th, and 7th Sessions. 8vo. Boston and Brooklyn, 1854–8.

Address delivered before the Norfolk Agricultural Society, at its first Annual Exhibition, 1849. By Hon. M. P. Wilder. 8vo. Pamph. Boston.

Second Annual Catalogue of the Officers and Students and Programme of the Course of Instruction of the school of the Massachusetts Institute of Technology, 1866–7. 8vo. Boston.

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A Catalogue of the Officers and Members of the Harvard Natural History Society. 8vo. Pamph. Cambridge, 1863.

Proceedings of the Chicago Academy of Sciences. Vol. I, Sign. 1–3. 8vo. 1865.

Deutscher Naturhistorischer Verein von Wisconsin, (Notice of.) 8vo. Pamph. Milwaukee.

The American Journal of Science and Arts. Nos. 123–128. 8vo. New Haven. 1866.

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Annals of the Lyceum of Natural History of New York. Vol. VIII, Nos. 8–10. 8vo. 1866.

Entomological Society of Philadelphia. Proceedings, Vols. II–V, VI, Nos. 1–2. 8vo. 1863–6. The Practical Entomologist. Vol. I, Nos. 7–12. Vol. II, Nos. 1–6. 4to. Philadelphia, 1866.

Academy of Natural Sciences of Philadelphia. Proceedings for the year 1866. 8vo. Journal. New Series, Vol. VI, Part 1. 4to. 1866.

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American Philosophical Society. Proceedings. Vol. X, Nos. 75–76. 8vo. Philadelphia, 1866. Catalogue of the Library. Part II. 8vo. 1866.

Transactions of the Academy of Science of St. Louis. Vol. II, No. 2. 8vo. 1866.

Public School Library Society of St. Louis. Systematic Index, Charter, Regulations and By-Laws. 8vo. Pamph. 1866.

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The American Naturalist. Vol. I, No. 1. 8vo. Salem, 1867.

California Academy of Natural Sciences. Proceedings. Vol. III; pp. 177–312. 8vo. San Francisco, 1866. Remarks of Robt. E. C. Stearns, and Resolutions of the Academy upon the death of Robert Kennicott. 8vo. Pamph. 1866.

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Outline of a Systematic Review of the Class of Birds. By Prof. W. Lilljeborg of Upsala. 8vo. Pamph. Washington, 1866.

Catalogue of the Reigen Collection of Mazatlan Mollusca in the British Museum. 8vo. Washington, 1855–7.

Annual Report of the Board of Regents of the Smithsonian Institution for the year 1865. 8vo. Washington, 1866.

Department of Agriculture. Monthly Reports, 1866, March, April, June and September–December. 1867, January–March. Bi-monthly Reports, September, 1864–December, 1865. 8vo. Washington.

Report of the Commissioners of Agriculture for the year 1865. 8vo. Washington, 1866.

Proceedings of the American Antiquarian Society, special meeting, March 16, 1866; semi-annual meeting, April 25, 1866, and Annual meeting, October 20, 1866. 8vo. Worcester.

By-Laws of the Worcester Lyceum and Natural History Association. 8vo. Pamph. *By Exchange.*

Memoirs read before the Boston Society of Natural History. Vol. I, Part 1. 4to. 1866.

On the Osteology and Myology of Colymbus torquatus. By Elliott Coues, M.A. (From Memoirs of the Society.) 4to. Pamph. Cambridge, 1866.

Proceedings of the Boston Society of Natural History. Vol. X; Sign. 25–end. Vol. XI; Sign. 1–4. 8vo. 1866–7.

Condition and Doings of the Boston Society of Natural History, as exhibited by the Annual Reports of the Custodian, Treasurer, Librarian and Curators. May, 1866. 8vo. Pamph.

Amtlicher Bericht über die Versammlung Deutscher Naturforscher und Aerzte. 1828–9, 1832, 1834, 1836, 1840. 19th (1841)–20th, 23d, 25th, 29th, 33d. 4to.

Deutsches Archiv für die Physiologie, herausgegeben von J. F. Meckel. Bänd. I–VIII. 8vo. Halle und Berlin, 1815–23.

Archiv für Anatomie und Physiologie. In Verbindung mit mehrern Gelehrten herausgegeben von J. F. Meckel. Jahr. 1826–32. 8vo. Leipzig.

Die Physiologie als Erfahrungswissenschaft. Bearbeitet von K. F. Burdach. Bänd. I–VI. 8vo. Leipzig, 1835–40.

Tagsberichte über die Fortschritte der Natur- und Heilkunde, erstattet von Dr. Robert Froriep. Abtheilung für Chirurgische Klinik. 1850–52. 8vo. Weimar.

Nordamerikanischer Monatsbericht für Natur- und Heilkunde. Bänd. II, III, IV, Nos. 1–5. 8vo. Philadelphia, 1851–2.

Journal für die Liebhaber der Entomologie. I. Band. I–II Stuk. 8vo. Frankfurt, 1791.

Zur vergleichenden Osteologie von Goethe, mit Zusaetzen und Bemerkungen von Dr. Ed. d'Alton. 4to. Pamph.

Beobachtungen auf Naturhistorischen Reisen von A. F. Schweigger. 4to. Berlin, 1819.

Ornithologiske og Icthyologiske Bidrag til den Grönlandske Fauna, af J. Reinhardt. 4to. 1837.

Reptiles et Poissons de l'Afrique Occidentale. Par M. le Professeur Aug. Duméril. 4to. Paris, 1861.

Essai d'une Erpétologie de l'Algérie. Par Alexandre Strauch. 4to. Pamph. St.-Pétersbourg, 1862.

Théorie du Squelette Humain, par Paul Gervais. 8vo. Paris, 1856.

Essai sur les Glaciers et sur le Terrain Erratique du Bassin du Rhone, par Jean de Charpentier. 8vo. Lausanne, 1841.

Histoire Naturelle des Corralliaires, par H. Milne-Edwards. Tomes I–III et Planches. 8vo. Paris, 1857–60.

Comparative Osteology. By Joseph Maclise. Folio. London, 1847.

A Handbook for Readers in the British Museum. By Thomas Nichols. 8vo. London, 1866.

Descripcion de diferentes Piezas de Historia Natural. Su Autor Don Antonio Parra. 4to. Havana, 1787.

Ueber die fossilen Insectenfresser, Nager und Vögel der Diluvialzeit. Von Dr. Rudolph Wagner, in Erlangen. 4to. Pamph.

Medizinische Zoologie. Von J. F. Brand und J. T. C. Ratzeburg. 2 vols. in one, and plates. 4to. Berlin, 1829–33.

Iconographie du Règne Animal de G. Cuvier. Insectes. Par M. F. E. Guérin-Méneville. 2 vols. 8vo. Paris, 1829–38.

Genera des Insectes. Par E. Guérin et A. Percheron. 8vo. Paris, 1835–8.

Toussaint von Charpentier's letzte Insectenabbildung, (Barbitistes Ocskayi). Mitgetheilt von Ocskay von Ocskö, Gravenhorst und Nees v. Esenbeck. 4to. Pamph. Breslau und Bonn. 1850.

Auszüge aus dem Berichte über eine an die nordwestlichen Küsten des Schwarzen Meeres und durch die westliche Krym unternommene Reise. Von Prof. K. Kessler. 8vo. Pamph.

Thesaurus Conchyliorum or Figures and Descriptions of Recent Shells; edited and illustrated by G. B. Sowerby. Part XXIII. 8vo. London, 1864.

Malakozoologische Blätter. Herausgegeben von Dr. Louis Pfeiffer. Bänd. XI; Bogen 7–end, XII. 8vo. Cassel, 1864–5.

Otho Fabricius. Fauna Groenlandica. 8vo. Hafniae et Lipsiae, 1780.

Essai sur l'Histoire Naturelle de St. Domingue. Par le P. Nicolson. 8vo. Paris, 1776.

Recherches anatomiques, physiologiques et zoologiques sur les Polypes. Par H. Milne-Edwards. 8vo. Paris, 1838.

Observations sur les Métamorphoses et l'Organisation de la Trichoda lynceus, par Jules Haime. 8vo. Pamph. Paris, 1853.

On the Morphology of the Reproductive System of the Sertularian Zoophyte, and its Analogy with the Reproductive System of the Flowering Plant. By Edward Forbes. 8vo. Pamph. London, 1844.

Œuvres Entomologiques de Th. Say. Recueillies et traduites par M. A. Gory, 1er Livr. 8vo. Paris, 1837.

Encyclopédie Méthodique. Histoire Naturelle des Insectes. Vols. I–VII, et Planches. 4to. Paris, 1789–1825.

Lepidoptères de la Californie. Par le Dr. J.-A. Boisduval. 8vo. Pamph. Paris, 1852.

The Oceanic Hydrozoa; a Description of the Calycophoridæ and Physophoridæ observed during the voyage of H. M. S. "Rattlesnake" in the years 1846–50. By Thomas Henry Huxley. 4to. London, 1859.

Catalogue of Orthopterous Insects in the Collection of the British Museum. Part I. Phasmidæ. By J. O. Westwood. 4to. London, 1859.

On the Anatomy of Vertebrates. By Richard Owen. Vols. I–II. 8vo. London, 1866.

The Geographical Distribution of Mammals. By Andrew Murray. 4to. London, 1866.

On the species of the Linnæan Genus Asterias. By Thomas Say. 8vo. Pamph. 1825.

Mémoire pour servir à l'Histoire des Blattes antédiluviennes. Par Dr. Berendt. 8vo. Pamph. Paris, 1836.

Die Insekten im Bernstein, ein Beitrag zur Thiergeschichte der Vorwelt. I. Heft. Von. Dr. G. C. Berendt. 4to. Danzig, 1830.

Locustarum quædam genera aptera nova examini submissa, G. Fischer de Waldheim. 8vo. Pamph. 1838.

Orthoptera Berolinensia. R. A. Philippi. 4to. Pamph. Berlin, 1830.

Orthoptera nova. Illustravit Franciscus L. B. Ocskay. 4to. Pamph. 1832.

Fauna der Kieler Bucht, von H. A. Meyer und K. Möbius. I. Band. Folio. Leipsic, 1865.

Symbolæ Physicæ seu Icones et Descriptiones Insectorum quæ ex Itinere per Africam Borealem et Asiam Occidentalem F. G. Hemprich et C. G. Ehrenberg. Percensuit Dr. Fr. Klug. Edidit Dr. C. G. Ehrenberg. Folio. Berolini, 1829–34.

The Natural History of the rarer Lepidopterous Insects of Georgia. By James E. Smith. Vols I–II. Folio. London, 1797.

Verhandelingen van het Bataviaasch Genootschap der Kunsten en Wetenschappen. Vols. I–III. 8vo. Batavia, 1779–81.

Tijdschrift voor Indische Taal–, Land– en Volkenkunde. Vols I–VI. 8vo. Batavia, 1854–57.

Natuurkundig Tijdschrift voor Nederlandsch Indie. Vol. I, Parts 1–6. 8vo. Batavia, 1850–51.

Allgemeine deutsche naturhistorische Zeitung. Vols. I–II. 8vo. Dresden und Leipzig, 1846–7.

Versuche und Abhandlungen der naturforschenden Gesellschaft in Danzig Vols. I–III. 4to. 1747–56.

Sitzungsberichte der Kais. Akademie der Wissenschaften. Math–nat. Classe. Bänd. I–II. 8vo. Wien, 1848–9.

Verhandlungen des naturhistorischen Vereines der preussischen Rheinlande und Westphalens. Jahrg. VI, VII, VIII; Bogen 1–16, 25–37, IX–XI. 8vo. Bonn, 1849–54.

Abdandlungen der naturhistorischen Gesellschaft zu Nürnberg. Bänd. I–II. 8vo. 1852–61.

Gesellschaft naturforschende Freunde zu Berlin. Mittheilungen aus den Verhandlungen. Jahr. I–III. 8vo. 1836–8. Schriften. Bänd. I–XI. 8vo. 1780–94. Kupfern, 4to.

Monatsberichte der K. P. Akademie der Wissenschaften zu Berlin. Aus dem Jahren 1849–51. 8vo.

Mémoires de la Société de Physique et d'Histoire Naturelle de Genève. Tom. I–VIII. 4to. 1821–39.

Memoirs of the Wernerian Natural History Society. Vols. I–IV and VI. 8vo. Edinburgh. 1811–32.

Anatomical and Pathological Observations. By J. Goodsir and H. D. S. Goodsir. 8vo. Edinburgh, 1845.

Catalogue of Shield Reptiles in the Collection of the British Museum. By John Edward Gray. Part I. Testudinata. 4to. London, 1855.

Mémoires sur les Coralliaires des Antilles, par P. Duchassaing de Fonbressin et Jean Michelotti. 2 vols. 4to. Turin, 1860–64.

Ueber Entwickelungsgeschichte der Thiere, von Dr. Karl Ernst v. Baer. Erster Theil. 4to. Königsberg. 1828.

Om de Geognostiske Forhold i en Deel af Sjelland og Naboeöerne ved G. Forchammer. 4to. Pamph. Kjöbenhavn, 1823.

Handbuch der Zoologie. Von W. C. H. Peters, J. V. Carus and C. E. A. Gerstaecker. Band II. 8vo. Leipzig, 1863.

The Record of Zoological Literature for the year 1865 (Vol. II). Edited by Albert C. L. G. Günther. 8vo. London, 1866.

Palæontographical Society. Vols. XVIII–XIX. 4to. London, 1864–5.

Johnson's New Illustrated Family Atlas of the World. Folio. New York, 1867. *By Purchase.*

Narrative of an Expedition to the Zambesi and its Tributaries; and of the Discovery of the Lakes Shirwa and Nyassa, 1858–64. By David and Charles Livingstone. 8vo. New York, 1866.

The Physiology of Man. By Austin Flint, Jr., M.D. 8vo. New York, 1866.

The History of Henry the Fifth. By G. M. Towle. 8vo. New York, 1866.

Frost and Fire. 2 vols. 8vo. Philadelphia, 1865.

The World before the Deluge. By Louis Figuier. 8vo. London, 1866.

Orographic Geology. By George L. Vose. 8vo. Boston, 1866.

Manual of Geology. By James D. Dana. 8vo. Philadelphia, 1866.

Thirty Years of Army Life on the Border. By Colonel R. B. Marcy, U. S. A. 8vo. New York, 1866.

History of England from the Fall of Wolsey to the Death of Elizabeth. By J. A. Froude. Vols. V–VI. 8vo. New York, 1866.

Curious Facts in the History of Insects. By Frank Cowan. 12mo. Philadelphia, 1865.

Geological Sketches. By L. Agassiz. 12mo. Boston, 1866.

Life of Mendelssohn, from the German of Lampadius. Edited and translated by W. L. Gage. 16mo. New York, 1865.

Mind in Nature. By Prof. H. James-Clark. 8vo. New York, 1866.

Frederick the Great and His Court. By L. Mühlbach. 8vo. New York, 1867.

The Albert Nyanza, Great Basin of the Nile and Explorations of the Nile Sources. By Samuel White Baker. 8vo. London, 1866.

A Year at the Shore. By Philip H. Gosse. 16mo. London, 1865.

Memorials of the Early Lives and Doings of Great Lawyers. By C. L. Brightwell. 16mo. London, 1866.

Life of Benjamin Silliman. By George P. Fisher. 2 vols. 8vo. New York, 1866.

Life and Letters of John Winthrop. By Robert C. Winthrop. 8vo. Boston, 1867.

The Open Polar Sea. By Dr. I. I. Hayes. 8vo. New York, 1867.

Deposited by the Republican Institution.

ADDITIONS TO THE MUSEUM FROM MAY 3, 1866, TO MAY 1, 1867.

May 16, 1866. Negative and photographs of a species of *Coscinodiscus*, by Dr. C. F. Crehore. Several Embryos of *Nyctiardea Gardeni*, from Canton, Mass., by Mr. F. G. Sanborn.

June 6. Albino muskrat from Long Point Marshes, Canada, by Dr. J. N. Borland. Forty specimens of Fossils, forty cases of Phryganidan larvæ, two hundred and twenty-five eggs, young and adult mollusca, and four insects, from Decorah, Iowa, by Mr. H. Davis. Pupa of *Libellula*, from Boston, by Mr. A. Chapman. One mammal, one specimen of *Ophiopholis bellis*, twelve crustacea, seventeen reptiles, five insects, six worms, and forty-six fish, by Mr. F. W. Andrews. Forty specimens of Cryolite and other minerals, from Greenland, by exchange with Mr. C. S. Hollowell. A collection of sixty-five specimens of minerals from various localities, by Dr. C. T. Jackson. A specimen of *Pœcilichthys cærulea* Storer, from Indianapolis, Ind., by Mr. W. B. Fletcher. A specimen of *Timarcha*, from Egypt, by Mr. C. K. Stevens.

June 20. Specimens of Nodular Copper Glance and Sulphuret of Copper, from Nova Scotia; Azurite, Malachite, Eurbescite, and vitreous Copper ore, from San Domingo, by Dr. C. T. Jackson. An albatross caught off the Cape of Good Hope; an owl taken sixty miles from Cape Horn; and specimens of Stilbite and Mesotype from Lyttleton, New Zealand, by Capt. Taylor. A young lion, by M. J. F. Wallboum. Specimens of Cryolite, Kyanite, Vermiculite and Pyrophyllite from the vicinity of Philadelphia, by Mr. J. M. Horner. A specimen of *Æschna*, by Mr. John Maury. Two Calabar Beans, by Dr. A. A. Gould. Hanging moss from the Southern States, by Mr. C. L. Brown. One hundred and eighty specimens of coleoptera from Lower California, by Mr. S. Hubbard. A *Remora* and an African Locust from the Nile River; sand from the Desert of Sahara; and a Horned Toad from the interior of Western Australia, by Dr. A. C. Garratt. A specimen of *Mesodesma arctatum* from Manchester beach, by Mr. S. Goldsmith. A bird from Hart's Location, N. H., by Dr. S. A. Bemis. Three echinoderms, seven fish, twelve birds, one hundred corals (twelve species), seven specimens of seeds and fungi, one skull and skeleton (in part), six *Bostrichidæ*, a quoit-like stone used in a game, a joint of bamboo, ten specimens of native Kapas, one specimen of *Argyroxiphum*, fruit of *Cucurbitaceæ*, forty miscellaneous fruits, one hundred insects, and several hundred specimens of lavas from the Hawaiian Islands; ten galls from Virginia City, Nevada; and twenty-five specimens of shells, by Mr. Wm. T. Brigham.

October 3. Two specimens of *Pimpla lunator* Fabr., and one of *Thyreus Abbotti*, from Boston, by Mr. T. T. Bouvé. Larva of *Deilephila*, from Boston, by Capt. W. T. M. Ball. An egg contained within two shells, from Roxbury, by Mr. T. J. Lee. Twenty-five fossil crabs, carboniferous? from Manhattan, Kansas, by Mr. B. F. Mudge. Skull of an Esquimaux dog, from Henley Harbor, Labrador; two Fox skulls, skeleton of a Bat, and skeleton of a *Rana*, from Concord, Mass., by Mr. H. Mann. Spirifers from an artesian well in Bothwell, C. W., by Mr. H. A. Lawrence. Massive garnet, from Arrowsic Island, Bath, Me., by Dr. A. S. Packard, Jr. Larva of *Cassida aurichalcea*, from South Danvers, by Mr. Benj. D. Hill. Jr. Ore of Antimony, from New Brunswick, by Mr. G. A. Boardman. One hundred and twenty-five specimens of minerals and ores, from Colorado, by Mr. C. J. Sprague. The skin of a large snake from Cuba, and a *Geotrupes*, from Bristol, R. I., by Mr. R. C. Greenleaf. A lower jaw and tibial bones of an Indian, from a mound in Fernandina, Florida; skull of a pig from Fernandina, Fla.; Coral from Florida Reefs; fossil Fish and Cephalopod, from Mt. Lebanon, Syria; Eagle claws and skull of a skunk, from Williamstown, Mass.; clay burrowed by *Termes frontalis* Hald., from Salem, Mass.; and two hundred and fifty specimens of Mollusca in alcohol, from New Braunfels, Texas, by Mr. S. H. Scudder. Shell ornament, from the West Indies, by G. H. Brown, M. D. Human fœtus, by Dr. W. J. Merriam. Six wild strawberries, from West Plymouth, N. H., by Dr. C. Pickering. Two hundred and fifty vegetable substances and fruits, from Bombay, by Mr. H. H. Rönne. Two specimens of *Trichostema dichotomum* var. *rubellum*, from Manchester, Conn., by Mr. C. H. Olmstead. Five specimens of Algæ, from Martha's Vineyard, by Prof. Gunning. Thirty specimens of birds, from India, deposited by Mr. Horace Mann. The bones of an elephant, by purchase.

October 17. Two bones of ray, a hog-nosed snake, an embryo of a shark, and three young crabs, from Cape Cod, by Mr. F. G. Sanborn. Twenty-three corals, from the East Indies, by Capt. R. C. Adams. Cast of a skull of a small Hippopotamus, from Liberia, by the Academy of Natural Sciences, Philadelphia. A fragment of bone, from Oregon, by Dr. H. C. Perkins. A specimen of *Blatta americana*, from East Indies, by Mr. C. Stodder. Nidus of Ichneumonidans, from Jamaica, by Dr. H. Bryant. Twelve specimens of *Gnaphalium leontopodium*, from the Tyrol and Erzgebirge, Saxony, by Mr. S. H. Scudder. Ten specimens of fruit of Sandwich Island Palm, and three fungi, from the Hawaiian Islands, by Mr. H. Mann. Bark of Australian Cinnamon, and five specimens of the fruit of Banksia, from Australia, by Dr. Ferd. Müller. Four hundred and fifteen shells, a barnacle and a stone adze, from the Hawaiian Islands; eight corals and nine shells, from Micronesia; and five hundred and seventy-six Mollusca, from the Marquesas Islands, by Rev. Edward Johnson.

November 7. A stone sinker, used by the Indians, from Martha's Vineyard, by Mr. J. C. J. Brown, Jr. Two lizards, three spiders and three crabs, from San Francisco, by Mr. C. A. Stearns. A spider, from Bengal, by Mr. H. H. Rönne. Flower-stalk of the date palm, from the Hawaiian Islands, by Mr. W. T. Brigham. Thirty-four specimens of birds, mostly from Malacca, by Mr. N. P. Hamlen.

November 21. Skull of *Felis domesticus*, Boston, by Dr. F. H. Brown. Specimens of *Coscinodiscus robustus. Auliscus cœlatus*, *Auliscus Hardmanianus*, *Glyphodiscus stellatus*, *Actinoptychus splendens*, *Actinoptychus nov. sp.*, and a Diatom from California, by Mr. C. G. Bush. A Crustacean, by Mr. R. C. Greenleaf. Three skins and two skeletons of mammals, from Belize, Central America, by Dr. Henry Bryant. A mineral, from Colorado, by Dr. H. W. Williams.

December 5. A fish, from the Grand Banks of Newfoundland, by Capt. N. E. Atwood.

December 19. Touchstones used by the old Italian goldsmiths for testing gold, by Mr. Wm. Munroe. Three specimens of mollusca and eggs and one Ray, from Nantucket, by Mr. H. D. Child.

January 2, 1867. Three Unionidæ and thirteen insects, from North Wrentham, by Mr. Luther Hills. A hybrid between Black and Mallard Ducks, and a Mallard Duck, from Lake St. Clair, by Major Lewis Cabot. A Hawk, from Canton, Mass., by Dr. S. Cabot. Wool from the Fleece of a Cotswold Ram, from Santa Barbara, Cal.; a fossil Crab and Drawings of a *Trachypterus*, from Neeah Bay, Washington Territory, by Mr. James G. Swan. Humerus of Indian, from the banks of the Merrimac, by Dr. W. M. Ogden.

January 16. A Bat, from Boston, by Miss Carrie Porée. Six specimens of fossil *Calamites*, from Pictou, N. S., by Mr. Joseph Wagner. A specimen of Bazanite, by Mr. Wm. Munroe.

February 6. Five specimens of fish from Lake Winnipisiogee, by Mr. G. D. Oxnard. Fungus on a Caterpillar from the Philippine Islands; and a specimen of *Diapheromera femorata*, from Cohasset, by Dr. S. Kneeland. A Collection of fourteen thousand, two hundred and eighty-four specimens of shells, by bequest of Miss Sarah Pickering Pratt. A Wasp's nest and two nests of Birds from North Wrentham, by Mr. Luther Hills. A shell from the Orchilla Islands, by Mr. DavidBaker. Fragment of a grape-vine eaten by *Termites*, with a section, from Salem, Mass.; and three specimens of *Faiderbia Bauhinia* Guérin, from West Africa, by Mr. S. H. Scudder. A slab and piece of shell marble, from Hudson River Marble Quarries, Greenport, Columbia Co., N. Y., by Mr. George B. Towle. A specimen of Coal worn by attrition to a globular form, by Rev. I. H. Holton.

March 6. Six specimens of minerals, from various localities, by Mr. T. T. Bouvé. A Sponge, taken from a depth of thirty fathoms, off Cape Cod, by Capt. N. E. Atwood. Three specimens of Guaranà, from Brazil, by Dr. B. E. Cotting. Seven specimens of *Lithocolletis robinicella* Clem., from Beverly, by Mr. Edw. Burgess. Radius of an albatross, from Cape Town, Africa, by Mr. G. R. Hemming. Sixteen fossils, from Dacotah; a Pipe Stone, from Pipe Stone Quarry; and a specimen of Kaoline (manufactured) from Chester Co., Penn., by Dr. F. V. Hayden. Casts of the jaws of *Titanotherium Proutii* and *Megalonyx Jeffersonii*, by the Academy of Natural Sciences of Philadelphia. A specimen of *Polycistina*, from deep sea soundings, north of Cuba, by Mr. C. G. Bush. Three hundred specimens of fossils, from the Bad Lands, Nebraska, by purchase.

March 20. Thirty-five specimens of fossils, from the Western States; and a Gar-Pike, from Lake Michigan, by Mr. C. G. Bush. Egg-shell, found inside of the white of the egg of a domestic fowl, by Mr. E. L. Sturtevant. A lizard, from Calcutta, by Mr. R. C. Greenleaf. Fifty-two nests and one hundred and twenty-one eggs, from Massachusetts, by Mr. B. P. Mann.

April 4. Five osteological specimens, a skeleton of a pony, a model of a horse, and three botanical specimens, by Mr. Francis Brooks. Two pairs of elk horns, from California, by Mr. Joseph Ballard.

April 17. A long-tailed duck, from the vicinity of Boston, by Mr. H. L. Lawrence. Two flying squirrels, from Hardwich, Mass., by Mr. Sam. Mixter. A specimen of *Certhiola Cabotii* Baird from Yucatan, by Dr. S. Cabot. A *Limax* from E. Somerville, by Mr. W. L. Robinson. An arrow-head and stock from Peter's Falls, W. Andover, and glass from the Portland fire, by Mr. F. G. Sanborn. A piece of the heart of a spruce, by Mr. Haines. *Calamites* from the Pudding Stone of Taunton, by Dr. J. Wyman. A sphere of vegetable fragments from a pond in Lincoln, by Dr. E. P. Colby. Twenty-five specimens of fossil mollusca from the Greensand of New Jersey, by Dr. C. T. Jackson. Six mollusca and four seeds from Ceylon, by Dr. S. Kneeland. A rose-breasted Merganser from Ipswich River, by purchase.

May 15, 1867.

The President in the chair. Thirty-one members present.

Dr. B. G. Wilder described a method he had used for the collection and arranging of information; he thought it superior to other methods when *all* the requisites are considered.

It consists in the brief statement of facts, ideas, or references to books written upon one side of a slip of paper five inches in length by two and one half in width, and equal to the sixth part of a sheet of note paper.

A few of these blanks are carried in the pocket, and advantage is thus taken of opportunities for recording and preserving information which the *time*, *place*, or state of mind, would not permit to be written out in full, or which might be forgotten before a fitting opportunity should occur.

These slips are then distributed at leisure into envelops, which are sealed at the side, but cut off at one end, the other end bearing the title of a subject.

By keeping these slips *separate* in envelops, it is evident that an indefinite subdivision of each general subject can be made by simply increasing the number of envelops and redistributing the slips.

The slips may then be used either for simple reference, or, if in preparation of a lecture or communication, by arranging them on the table in any desired order, and then transcribing parts of them in form of notes: while for a written paper they serve to indicate the general order of discussing a subject.

He thought this method superior not only to note-books, and writing out in full at the time, but also to other forms of small notes, especially when the slips are in any way joined together.

The method proposed makes sure of the essential fact or idea in a brief form, and the slips, being kept separate and of uniform size, may easily be carried and arranged, or reärranged in any order at any time.

Dr. Jeffries Wyman stated that he had recently examined the shell-heaps found in Salisbury, near Newburyport, about a mile from the Merrimac, and an equal distance from the seashore. There were thirteen within the limit of a mile, varying in diameter from twenty to one hundred and fifteen feet. The mounds were well known, and everything of special interest had long since been removed. His object at this time was to discover what traces remained of man's agency in their construction. In eleven of them only chips of flint could be found here and there; and in the other two, and especially in one of them, large numbers of these were picked up, in all about five pounds. One or two complete arrow-heads and a few fragments were noticed; in contradistinction to the mounds of Florida, no bones of animals were discovered, and but very little pottery.

Mr. Horace Mann stated that in Concord, on the Concord River, there was a bluff fifteen feet high, filled with shells of mussels (*Unionidæ*), in which split bones and the upper arm of the beaver, together with considerable pottery and arrowheads had been found by Mr. Thoreau.

Dr. Samuel Kneeland read the following letter from Mr. Josiah Curtis of Knoxville, Tenn.: —

"I send you enclosed a photograph of an image, or marble statue, said to have been recently found in a cave about twenty miles, a little north of east, from this city. The following is about all I can say of it. Some workmen building a railroad bridge over the Holston River, at Strawberry Plains, some sixteen miles from here, on the East Tennessee and Virginia railroad, are credibly reported to have visited a cave long known to exist, some four miles from the scene of their labors. Curiosity led them to an apartment which apparently had not been visited for an unknown period. In that apartment they found the 'Image' evidently cut from the solid rock, as it was still firmly attached thereto by a pedicle some two or three inches in diameter and twelve inches long, extending from the back of the head in a sort of 'chignon.' The men broke it from its position and sent it to this city. I took it to the Artists' Gallery and had a few photographs made. The statue is of solid marble, and is twenty inches high, seven inches deep at the base, and three and one-half inches wide. I hope soon to visit the cave and verify what seems unquestionable. I hope also soon to be able to secure some bones, which are said to be human bones. They are reported to have been washed up by the late floods on the Pigeon River, some twenty-five miles south-east of this place towards the Great Smoky Mountains."

Dr. C. T. Jackson mentioned that he had recently returned from the gold regions of Vermont. The great Appalachian gold belt passed through Plymouth and Bridgewater; the talco-micaceous slates contain gold, both in the slates themselves and in the quartz veins. The value varied from four dollars to twelve dollars per ton. He had obtained specimens showing visible particles of gold which he would at some time present to the Museum.

Maj. Lewis Cabot of Brookline, Dr. A. C. Garratt and Messrs. Charles B. Brigham, William Parsons, B. B. Williams and C. J. Whitmore, were elected Resident Members.

June 5, 1867.

Mr. C. K. Dillaway in the chair. Thirty-two members present.

The following papers were read:—

ON THE POSITION OF THE SANDSTONE OF THE SOUTHERN SLOPE OF A PORTION OF KEWEENAW POINT, LAKE SUPERIOR. BY ALEXANDER AGASSIZ.

Foster and Whitney, in their Report of the Lake Superior mineral district, represent the sandstone on the south side of the trap range of Keweenaw Point, as dipping south and resting conformably upon the beds of trap of the north side of the anticlinal axis of Keweenaw Point. This anticlinal axis formed by the Bohemian Mountain, as asserted by Foster and Whitney, is not found further south as far as I have had occasion to examine. In two of the ravines cut through the sandstone by creeks flowing in an easterly direction from the crest of the range towards Torch River, near the head of Torch Lake, we find good exposures of the sandstone, and in two points, one of which was examined by Foster and Whitney, we find the sandstone resting unconformably upon the trap which has still the same northern dip as further west, of about 42°. The sandstone within a distance of one hundred feet from the trap, dipping north 42°, lies horizontally, or rather has at the outside an inclination of $1\frac{1}{2}°$ or 2° south. The peculiar bed of chloritic rock, so characteristic of the junction of trap and sandstone as described by Foster and Whitney, is well marked, but we can find no trace whatever of any anticlinal axis at these two ravines, which are about two miles apart and present identical features. One of these ravines commences in the property of the St. Louis Mining Company, Section 19, Township 56, Range 32 north, about one and one-half miles south of Calumet. An old adit entering from the ravine into an abandoned lode plainly shows that the formation still dips about 42° north. About six hundred feet further east, following the ravine where the dip of the formation does not change, we come upon the bed of chloritic rock forming the junction of sandstone and trap, and about one hundred feet further down the ravine we come upon horizontal beds of sandstone reaching to the very crest of the ravine, here about one hundred feet deep, plainly showing that the sandstone rests unconformably upon the trap which has a dip of 42° north. These same horizontal beds can be traced the whole length of the ravine, for a distance of over one and a half miles. The same is the case at the Douglass Houghton Creek in Section 36, Township 56, Range 33 north, where the creek winds its way through a deep ravine cut out of the sandstone, and at the junction of the sandstone and trap, falls a depth of one hundred and seventy-two feet. The chloritic bed is well developed on the south side of the creek, while the north side is more greenstone, and all along the whole length of the ravine up to the falls, a distance of one and one-half miles, the horizontal beds of sandstone are readily traced, dipping slightly north near the falls, and being horizontal at the opening of the ravine into Torch River valley, plainly showing that they rest unconformably upon the trap range. On examining this sandstone more carefully, we find that the strata are made up of alternating layers of sandstone of reddish or yellowish grain, and of beds of loose sandstone containing boulders; some of the beds of boulders resembling what is common on seashores as a mixture of mud and shingle. On breaking open several of the small boulders taken *in situ* from the beds we find that they consist mostly of reddish trap, but frequently we come across perfectly well waterworn boulders of greyish trap containing amygdales, identical with the trap of the copper range a short distance west from these beds of sandstone, plainly showing that the sandstone was deposited upon the shores of the ridge of trap forming Keweenaw Point, and has not been uplifted by it as is stated by Foster and Whitney. The case is totally different with the sandstone north of the range that lies conformably upon the trap, but the sandstone of the southern side of the mineral range in the vicinity of Torch Lake is plainly of a different age, lying, as it does, unconformably upon the former. I shall be able, I trust, to make a more careful examination of this subject, and by examining a greater number of points, the discrepancy between the observations of Messrs. Foster and Whitney and mine may be explained. Mr. L. D. Emerson, a mining engineer, who examined these points with me, for a long time resident of Ontonagon County, tells me he has observed a similar state of things at the junction of the trap and the sandstone at Forest Falls and in a southerly direction from Minnesota mine on the south boundary of the range, and that he found there the sandstone beds resting unconformably upon the beds of trap dipping north.

ON SYMMETRY AND HOMOLOGY IN LIMBS. BY DR. J. WYMAN.

Anatomists who have compared the fore and hind limbs of man and animals, have mostly described them as if they were parallel repetitions of each other, just as are any two ribs on the same side of the body. By a few they have been studied as symmetrical parts, repeating each other in a reversed manner from before backwards, as right and left parts do from side to side.* We have adopted this last mode of viewing them, because, though open to grave objections, as will be seen further on, the difficulties met with are, on the whole, fewer than in the other, and because too, it is supported by the indications of fore and hind symmetry in other parts of the body.

Among animals, two organs or parts, generally speaking, are said to be symmetrical when they are situated on opposite sides of an axis, and are alike in form and size, but one is the reverse of the other, as is everywhere obvious in those which are right and left. It is not to be understood, however, that this likeness is absolute; for while it is very generally true that such right and left parts are alike in size and form, or very nearly so, it occasionally happens that they are very unlike in these respects, still retaining, however, a certain amount of symmetry. We have striking illustrations of this in the claws of many Crustaceans, as in *Astacus* and *Gelasimus*, and in the right and left halves of the body of *Bopyrus*. Among Acephalous Molluscs, this difference is in some cases very remarkable, as in *Radiolites*, *Monopleura*, etc., where one of the valves is conical and spirally twisted, while the other is quite flat, and in its relation to the other valve, resembles the operculum of certain Gasteropods.

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*The following are among the more recent articles in which the homologies of the limbs and their symmetry are treated of at length.

S. R. Pittard. Article Symmetry—Cyclopædia of Anatomy and Physiology, Vol. IV, p. 845.

Observations on the Limbs of Vertebrate Animals. By George Humphrey, M. D., F. R. S., etc., Cambridge, 1860.

Charles Martins. Nouvelle Comparaison des Membres. Mémoires de l'Acad. des Sciences de Montpellier T. II, p. 461. 1857.

Also by the same author, Mémoire sur l'Ostéologie Comparée des Articulations du Coude et du Genou. Ann. des Sciences Naturelles. T. XVIII. 4^{me} série. 1862.

Homologies des Membres Pelviens et Thoraciques de l'Homme, par le Docteur Foltz. Journal de Physiologie, T. VI, 1863, p. 49.

On Morphology and Teleology, especially in the limbs of Mammalia. By Burt G. Wilder, S. B., Cambridge, 1865. From the Memoirs of the Boston Society of Natural History.

Also by the same author, Morphological Value and Relations of the Human Hand. Am. Journal of Science, Vol. XLIV, July, 1867, p. 44.

Among Vertebrates such differences are much less frequently met with; they however exist, and symmetry of right and left parts, even in the human skeleton, is not constant; it may even be doubted whether absolute symmetry exists anywhere. Attention has recently been called to asymmetry in the base of the skull, and by a comparison of the bones of the fore arm in ten skeletons, we have found the right ulna longest in eight, the left in one, and in one the right and left bones were equal. Differences in length and weight were also found in the clavicles, the humerus, and other parts of the skeleton, but in different degrees. The close approach to absolute symmetry in some of the minuter details of structure is sometimes quite remarkable, as in the arrangement of the papillæ on the tips of the fingers and toes of most individuals; in some, however, the asymmetry of these parts is quite marked, and in others even the pattern of the figure on the two sides is changed. More marked instances of asymmetry exist in the unequal nostrils, and more or less bent vomer of some Cetaceans, in the rudimentary right, but immensely developed left tusk of the Narwal, in the lower jaw of the adult male Mastodon which has a tusk on the left side, but none on the right, in the unequal development of the ovaries and oviducts of most birds, as also in a similar condition of the carotid arteries. In the human brain the hinder lobe of one of the hemispheres, more commonly the left, is longer than the other, as may easily be seen in the cranium by the depth of the corresponding fossæ. In the illustrious Bichat, the inequality of the two sides of the head amounted to deformity. The most striking instances of all are to be found in the halibut (*Hippoglossus*), flounders (*Pleuronectes*), and other flat fishes, in which the bones of the face, the brain and organs of sense are all more or less distorted, and the eyes especially are unsymmetrically placed.

All organs which are thus unlike or unsymmetrical in the adult, have been shown by embryologists, as by Steenstrup in the case of the flat fishes, and also in the crabs, molluscs, etc., by other observers, to be alike in the embryo, the deviations from true symmetry taking place as development advances. We have seen a lobster nearly three inches in length, in which the right and left anterior claws were still symmetrical.

The organs of the great cavities in adult vertebrates are almost uniformly unsymmetrical; nevertheless in the embryo the symmetry of these parts, even of the liver, is complete. In some fishes this is true of the liver of the adult, and in a few instances this is divided into a right and left organ. The fundamental idea of the organs of organic life involves the condition of symmetry.

The other kind of symmetry, viz., that which is believed to exist between the fore and hind parts of the body is much less obvious, and would in fact be generally overlooked, the deviations from true symmetry being so great. In many Articulates, however, this deviation is comparatively slight, especially in the genera *Jaera* (Fig. 1), *Oniscus*, *Porcellio*, *Asellus*, *Cymothoa*, and other Isopods, also among Myriapods, as in the genera *Scutigera*, *Scolopendra*, etc., in which the limbs are repeated oppositely, though with different degrees of inequality, from the centre of the body backwards and forwards. If to the general symmetry of such fore and hind parts we add certain details of structure occasionally seen, especially the fact that some of the worms and Crustaceans have organs of special sense developed in the last as well as in the first segments, the evidence that the fore parts are repeated in the hinder becomes much stronger.*

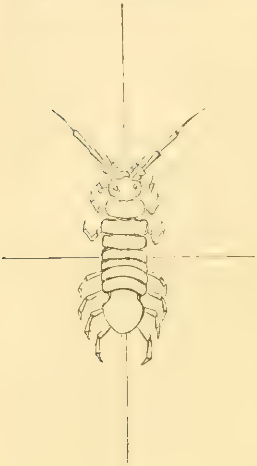

Fig. 1.

Among Vertebrates, as will be seen further on, the resemblance between the fore and hind limbs is quite obvious, and the symmetry of plan easily recognized; but in the majority of animals, whether vertebrate or invertebrate, fore and hind parts, though symmetrical in plan, actually differ largely from each other, both in size and form, and thus present a distorted symmetry like that which has already been noticed between right and left parts. The analogy holds still further, since the fore and hind limbs, however widely they may differ in the adult, are as nearly alike in the early embryo as are corresponding limbs on the right and left sides. In right and left parts, however, distorted symmetry is the exception, while in the fore and hind parts of *adults* it is the rule.

A sufficient explanation of this deviation from complete symmetry is found in the circumstance that in right and left parts the functions are generally similar and equal, while this is seldom the case in fore and hind ones. Identical and homologous parts having similar and equal functions will have equal growth and development, while the reverse will be the case in those having the opposite conditions. A close approach to fore and hind symmetry of limbs is found in certain swimming animals, as the *Ornithorhynchus* and *Ichthyosaurus*, while extreme asymmetry is found in birds, in which aerial locomotion belongs to the arms, and land or aquatic locomotion to the legs, or as in the kangaroos and other jumping animals, where the hind limbs predominate so largely over the fore ones, and in the apes and three-toed sloths, where the reverse is the case. Similar extreme differences are still better indicated by the animals whose tracks are left in the Connecticut River sandstones, as for example, in *Anomoepus* and analogous forms.

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* Leuckart and Van Beneden have shown that *Mysis* has an ear in the last segment, and Schmidt has described an eye in the same part in *Amphicora*, a worm. Nat. Hist. Rev., April, 1862, p. 133. See also Quatrefages, Mémoire sur la Famille des Polyophthalmiens, Ann. des. Sc. Nat. 3^{me} série, T. XIII, p. 5.

The facts brought to light by the study of embryos, offer additional evidence in support of the view that the fore and hind portions of the body are in idea symmetrical. As already stated, this is the more noticeable the nearer the embryo is to the earliest stage of its development; and it is to this that attention should be carefully turned, for as the embryo becomes more specialized, and its organs take on those forms which adapt the individual to its future conditions of life, the differences rapidly increase.

In the general development of the vertebrate embryo, the *first* fact which strikes us, as it increases in size, is, that this increase is not from a growth from before backward, but from a central, and, as it were, a neutral point, both backwards and forwards, so that the two ends are made to recede from the centre in opposite directions, just as do the radicle and plumule of a plant from the point where these are continuous. By this process the head and tail both become free, while the central part of the body remains attached to the yelk. *Secondly*, the primitive groove of the nervous axis in its earliest stage (Fig. 2) is nearly symmetrically enlarged at either end, so as to form two opposite dilatations: one the precursor of the future cerebral vesicles, and the other of the rhomboidal sinus, which last has only a temporary existence in the mammals, but is permanent in the birds.* *Thirdly*,

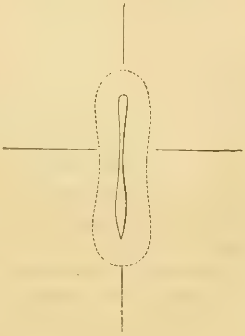

Fig. 2.

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* In some adult fishes the spinal marrow ends in a ganglionic enlargement, forming a kind of caudal brain. We have found such a ganglion quite conspicuous in the American *Lophius*, and Quatrefages describes one in *Amphioxus*, which is all the more striking, since it is only a diminutive repetition of the fore end of the axis. The distribution of the last pair of nerves, as seen in his admirable figures, is also symmetrical with that of the first.

when the spinal groove closes up by the union of the dorsal laminæ, it does so, as Reichert has shown, by the union of its lips, first in the middle portion, and then gradually in a symmetrical manner towards either end. *Fourthly*, in the four classes of vertebrates the first traces of the vertebral segments are to be found in three or four pairs of plates which appear on either side of the primitive axis midway between the two ends, from which region they are multiplied and extended forwards to the head, and backwards to the tail, by the development of new plates, thus lengthening the column in a symmetrical manner (Figs. 3, 4). The ossification of the bodies of the vertebræ takes place in the same order, beginning in the middle and extending in either direction. During the first half of fœtal life, and even be-

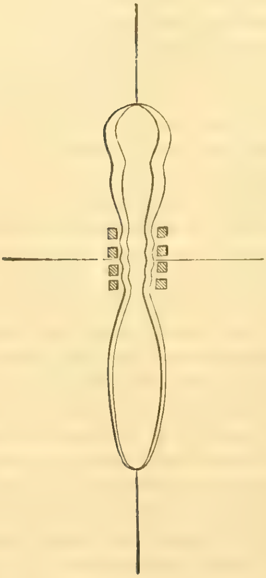

Fig. 3.

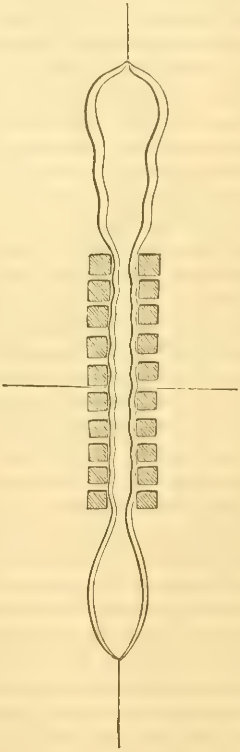

Fig. 4.

yond it, in the human body, the bodies of the vertebræ first ossified, viz., those in the middle, are the largest, and from these the column of bodies gradually tapers to the head and coccyx. It is only towards the end of fœtal life that the lumbar vertebræ assume larger proportions. *Fifthly*, a resemblance analogous to that which exists between the opposite ends of the nervous system and of the vertebral column, can also be traced in the intestinal canal. Oken first maintained the idea that the oral and anal portions of this canal repeat each other. Notwithstanding the ridicule which has been directed to this view of his, fairly examined, it will be found to have, underlying it, at least the semblance of a truth. The two opposite ends agree in this, that in the embryos of all air-breathing animals there is developed from the abdominal side of each end of the straight symmetrical intestine a sac; that in front forming the lung, and that behind the allantois, and each opening into the intestine by a narrow neck. The allantois as well as the lung is a respiratory organ, but it is not justifiable to cite a function as an indication of homology. The correspondence between the two ends of the canal is still further, but less clearly, indicated in the subsequent division of them, the fore end into mouth and nostrils, or respiratory and digestive portions, and the hind into anal and genito-urinary portions, and still further by the development of the tongue on the floor of the mouth, and of the male organ on that of the genital portion of the intestine. In most mammals the genito-urinary portion becomes wholly separated from the digestive, while the respiratory does not. Nevertheless in the embryo the first retains its connection for a certain time, as is permanently the case in the birds and reptiles.

The most striking facts bearing upon the idea of fore and hind symmetry are to be found in the development of the limbs. Von Baer has described the phases which the limbs assume, as also their attitudes as they advance towards their permanent condition. We have traced these successive positions in several embryos, and from them the following description is drawn. The limb-buds, when first formed, are simply tegumentary outgrowths, and project at right angles from the sides of the body in the form of half oval discs. As they increase in length they become divided into a somewhat flattened, disc-like end, which becomes the future hand or foot, and a pedicle which connects this with the trunk. This pedicle is transformed into the fore arm and leg, and partly into the arm and thigh; the remaining portions of these last, when developed, result from a still further outgrowth from the body which takes place at a later period. In the *second* stage the limbs are each bent to an angle at a point near the trunk, so that their ends are directed downwards, and what were previously the under sides of the disc-like hands and feet (the body being supposed to be horizontal), have now become vertical and face inwards; they are the soles and palms. The angle formed in the limbs corresponds with the elbows and the knees, and thus marks off fore arms and legs from arms and thighs, these last being very short. *Thirdly*, during the stage just mentioned, both upper arms and thighs projected at right angles from the sides of the body. They now begin to change their direction with reference to the trunk, but in a perfectly symmetrical manner. The elbow which has thus far projected outwards, now swings backwards to the side of the thorax, and the knee forwards towards the side of the abdomen. This condition of things is readily seen in a human embryo in the writer's collection, measuring 0.60 inch in length, and represented in Fig. 5. The effect of this change of position would be to make the palms face forwards, and it makes the soles face partly backwards. This tendency, however, as regards the hand, is counteracted by a remarkable change of position in the fore arm. This is slowly rotated inwards, so that the palm is made to face almost backwards. In those animals which walk on the palms of their hands, the hand is bent on the fore arm, so that its back is raised, the palm directed more or less downwards, and thus the limb is adapted to walking or crawling. At the same time a similar change takes place in the feet, the backs of which are raised towards the fore part of the leg, and the toes directed forwards, and the sole downwards. The rotation of the fore arm just mentioned is the chief cause of the interference with the symmetry of the limbs; were it not for this the hands and feet would have assumed exactly symmetrical attitudes, the toes projecting forwards and the fingers backwards, the back of the foot looking towards the fore part of the leg, and the back of the hand towards the hind part of the fore arm.

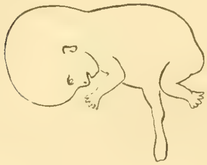

Fig. 5.

If we admit the idea of symmetry in structure between arms and legs, and would compare the movements of the two in man and animals, we must change in some respects the terms flexion and extension, from those ordinarily used in the description of the human body. We will suppose the human skeleton suspended with the vertebral column horizontal, the limbs slightly flexed, the toes and fingers pointing downwards, the palms facing forwards and the soles backwards. Flexion of the humerus would be backwards, of the femur forwards; of the fore arm forwards, of the leg backwards; of the hand backwards, that is by carrying the back of it towards the back of the fore arm, and the foot forwards. Thus the movements would be symmetrical throughout in the two limbs. Supposing the limbs to be of equal strength, somewhat flexed, the soles and palms resting on the ground, they would antagonize each other in their action; the fore limbs, if extended, would, in consequence of their obliquity, tend to push the body upwards and backwards, and the hind limbs under the same conditions upwards and forwards. The two acting together would give rise to a resultant motion upwards. By the rotation of the fore arm in the embryo the action of the fore limb is reversed, and thus in the forward movement of the body coöperates with, instead of antagonizing, the hind limb.

When fully developed, therefore, the fore and hind limbs of animals have a general symmetry except in the following respects; the bones of the fore arm cross each other, while those of the legs do not, and the toes and fingers are both directed forwards. If, however, the fore arm be rotated outwards through half a circle, so as to make the bones parallel, as in the leg, thus counteracting the change which took place during development, the *general* symmetry would be restored, and be complete. There would, however, exist a certain amount of special asymmetry in the position of the thumb and great toe, for these would be on opposite sides of the two limbs. Of this difficulty we shall speak again further on.

The symmetry of disease to which attention has of late years been called,* also helps to sustain the idea of fore and hind symmetry. Certain maladies, as psoriasis, leprosy, syphilis, etc, not only attack corresponding or symmetrical portions of right and left parts, but also of fore and hind parts. Certain skin diseases attack the backs of the hands and feet, or the palms and soles, or the elbows and knees. The earthy deposits in the arteries show a similar tendency to symmetrical distribution. Such instances, however, are quite rare in comparison with the vast proportion of diseases in which no such tendency is apparent. They nevertheless tend to show that homologous parts, either on the right and left, or fore and hind parts of the body, have such a constitution that they are more amenable to the influence of a given disease than other parts.

We pass by only with a mention a third kind of symmetry, which has been much insisted on by some anatomists, viz., that between the dorsal and abdominal parts. Under certain circumstances this kind of symmetry becomes almost exact, as may be seen, for example, in a vertical section of the tail of a fish, where the arrangement of the bones, etc., below a horizontal line, passing through the vertebral column, is only a reversed copy of the parts above.

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* William Budd. Medico-Chirurgical Transactions, London. Vol. xxv, 1852.
James Paget. Surgical Pathology. Philadelphia. 1860. p. 27.
Burt G. Wilder. Pathological Polarities, or What has been called Symmetry in Disease. Boston Medical and Surgical Journal, April 5th, 1855.

The statements which have been made in the previous pages are intended to show that even in right and left parts, symmetry is of various degrees, and is rarely, if ever, absolute. Asymmetry, however, is in most cases slight, but may in certain others become as great as that between fore and hind limbs, in accordance with the degree of difference in the function of the two sides. These differences do not, nevertheless, prevent our recognizing the idea of symmetry of plan underlying the structure of such parts. In comparing fore and hind limbs, it has been shown that they are sometimes nearly symmetrical, but generally the symmetry is largely distorted. But if we bear in mind the fact that the limbs which in the adult are the most unsymmetrical, are quite symmetrical in the embryo, the hypothesis that the idea of symmetry underlies their structure is rendered highly probable.

Analogy between symmetry and polarity. From what has been stated it is obvious that in the early stages of development there is at work a force which regulates the distribution of the particles of matter out of which the embryo is formed in a symmetrical manner, and that up to a certain stage there is symmetry, not only of right and left, but of fore and hind parts. The essential characteristic of this force is that it gives rise to similar but reversed forms on the two sides as well as on the two ends of the axis of the body.

If we look for any thing among known forces analogous to this force, it is to be found, if anywhere, in those known as polar forces. The essential features of polarity, as of symmetry, are antagonism, oppositeness or inversion, either of qualities or forms. Studying the subject from the most general point of view, there are striking resemblances between the distribution of matter capable of assuming a polar condition, and free to move around a magnet, and the distribution of matter around the nervous axis of an embryo.

In every complete series of magnetic curves formed by particles in a polar condition, there are two neutral lines (Fig. 6, A), one extending lengthwise of the magnet, so that the curves formed may be divided into right and left; secondly a transverse one, the particles on each side of which form the north and south curves, or which for purposes of comparison might be called fore and hind curves. In the right and left series those which are on one side of the long axis are symmetrical with those on the other and not in themselves, and in the north and south series those on either side of the transverse neutral line are symmetrical with each other, and not in themselves.

If these curves are projected on paper, and this be folded on the line of the longitudinal, or north and south axis, the curves of opposite sides or opposite ends will correspond as right and left hands or other double organs do when applied to, or placed opposite each other.

The same is true of the north and south curves when the paper is folded on its transverse axis.

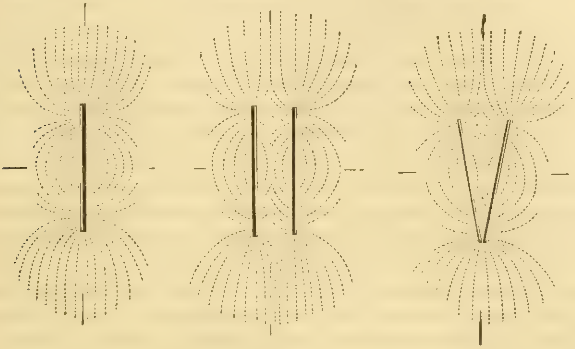

Fig. 6.

The distribution of particles just described, corresponds, first, to all that we designate as right and left in normal development; second, to all that we designate as fore and hind with reference to the long axis of the body, and which is characterized by symmetry in structure.

Not only is there this analogy between the distribution of matter around a magnet, and that around the nervous axis of the normal embryo, but the analogy is still more striking in the curves formed by the combined action of two adjoining magnets and the appearances found in more or less double monsters.

If two magnets are placed parallel to each other, and at a distance, two sets of curves are formed as in the usual way; but if they are brought so as to be within each other's influence (Fig. 6, B), the two magnetic figures are combined, and now form a single compound one, the middle portion of which consists of the curves from the two adjoining sides of the magnets; and the particles from either series of curves do not pass beyond the line where the forces of the two magnets are in equilibrium, but are deflected upwards or downwards, north or south. In this manner that portion of the figure formed by the particles arranged between the two magnets becomes symmetrical, one half consisting of particles belonging to the right magnet, and the other half of those belonging to the left. The symmetry of the whole compound figure thus formed is in all respects as perfect as that of the ordinary figure from a single magnet. If such a compound figure is projected on paper, and this be folded on either the longitudinal or transverse axis of the *whole* figure, the opposing halves will correspond. The right and left curves belonging to the *same* magnet will not now be symmetrical with each other, but all the curves formed by one magnet will be symmetrical with those formed by the other.

In abnormal development, if two nervous axes are formed on opposite sides of one and the same yelk, each axis, or rather the symmetrical force, the axis of action of which corresponds with the nervous axis, will distribute the organic matter under its influence without coming in collision with that of the other, except near the umbilicus, so that two nearly perfect embryos will be formed, as in the case of the Siamese twins.

If the two axes are formed side by side, and so near to each other that the particles under their respective influence come in contact, then at the line of contact a series of intermediate organs or limbs, will be formed in connection with the two axes, as is commonly seen in those double monsters which present what is called lateral doubling. Here, too, as in the case of the double magnetic curves, the right and left parts connected with one and the same nervous axis will no longer be symmetrical with each other, but those connected with the right half of one axis will be symmetrical with those connected with the left half of the other, or in other words, the two bodies thus united will be symmetrical with each other, but will not be bilaterally symmetrical in themselves.

If the magnets are now inclined towards each other (Fig. 6, C), so as to touch at one end, forming a V, then we shall have the particles arranged so as to produce a figure double at one end, but single at the other. The ends of the magnets which are separated will arrange their particles so as to form a double series of curves, which are completely independent of each other; but as the magnets come nearer together the intervening curves are gradually modified or suppressed, and at last a single symmetrical terminal figure is formed. One half of this terminal portion is however formed under the influence of the right, and the other of the left magnet.

Likewise in certain double embryos if the axes are inclined so as to form a V-shaped figure, the two separated ends will have a head more or less complete, but as the two axes converge below, the organs become more or less fused and suppressed, and at length the hindmost are reduced to the normal type, all intermediate ones having become obsolete. The body will be provided with two legs, but one will be connected with, and under the control of the right axis, and the other under that of the left. Precisely such a case is found in the well known instance of Ritta-Christina. The completeness of the intermediate organs in a given instance, as in the case of the intermediate magnetic curves, will depend upon the degree of divergence or separation of the axes.

In comparing the results of the symmetrically acting force in animals with a polar force like that of magnetism, it is not intended to imply that the two forces are the same, but only that they have like modes of acting, and that when left to themselves undisturbed by other influences, each tends to produce symmetrical figures. The type or general idea of any of the double monsters may be imitated by the combined action of two magnets.

In the preceding paragraphs we have spoken of the symmetrical distribution of the particles of matter around the nervous axis as if the distributing force emanated from this axis. It is not to be inferred that such is actually the case, since the force is already in action before the nervous axis itself is formed, and may be said to be manifested in the first stage of the segmentation of the yelk; for when the whole yelk, or as in some cases, a limited portion of it, divides into two distinct segments, such division shows that a symmetrically acting force is already present; in fact, we have now right and left parts. Such force is again manifest when a new division takes place at right angles to the first, separating each right and left portion into two others, which may be compared to the fore and hind divisions of the body; even the nervous axis itself is symmetrically developed under the influence of this same force. The nervous axis, however, when formed, coincides with the axis of the symmetrically-distributing force.

The use of the term polarity in connection with organic structures has long been familiar to physiologists, but apparently with very varied signification. Oken in his celebrated "Programm" uses the following words with regard to the skeleton: "This skeleton repeats itself at the two poles; each pole repeats itself in the other, and they are head and pelvis." It does not appear from this, nor from any other statement of his that we have seen, precisely what he understood by the word pole. At the present day few will agree with him that the head and pelvis repeat each other. Still, although these parts are not comparable, the idea underlying his statement, viz., that the two ends of the body do repeat each other, may be, and we believe is, correct.

In order, however, that they may be repeated as if under the influence of a polar force, or of a force acting in a manner analogous to one, there should be a more or less symmetrical repetition of homologous parts.

The term pole is often used in the description of eggs and of cells; in the former to distinguish the portion of the egg where the oily matters are collected from the opposite side where there is only albumen, and in the latter, simply to designate the two ends without intending thereby to imply any difference of quality or force. In the nervous system cells are described as "unipolar," "bipolar," or "multipolar," which only means that they are prolonged into one or more points, "caudate appendages," or processes which connect them with the nerve tubes.

Owen appears to make use of the term polarity in the sense in which it is made to stand as representing the quality of a force acting in animal bodies, and producing symmetrical results. After comparing the dorsal and abdominal portions of the vertebral arches, and showing that they repeat each other, he says "symmetry and polarity, or serial homology of the parts of the same vertebral segment is usually still more strictly observed in the transverse direction, and is so obvious as to have immediately led to the detection of the homologous parts, which are accordingly distinguished as right and left."* He does not, however, recognize the symmetry of fore and hind parts.

Prof. Dana uses the term in the same manner. "An animal is embodied or concentrated force, which force manifests polarity in the results of its action in development, that is in the oppositeness of the anterior and posterior extremities of the structures evolved, and also in the dorso-ventral relation of these structures." †

Polarity, according to Mr. Faraday, may be considered as "an axis of power, having contrary forces exactly equal in opposite directions." This power will produce perfectly symmetrical figures, however, only when wholly free from the influence of a superior force. In the presence of such it may be interfered with, or have the results of its action so changed as to give rise to forms whose symmetry is more or less distorted, as is so frequently the case in crystals; these, we are told, being exactly symmetrical only in idea.

In the vertebrate animal, the plan of construction appears to be in accordance with the idea of general symmetry, which in the early stages of development is maintained at the two ends as well as the two sides of the axis, but subsequently is more or less interfered with to adapt the animal to its special conditions of life. This force, producing symmetry, acts in a manner analogous to a polar force. To designate the disturbing, or rather adapting force, by which the force tending to act in a symmetrical manner is interfered with, we must still retain the term vital or life-force, although this may in the end prove only a physical force acting under special conditions.

Homology. Owen defines a homologue to be "the same organ in different animals under every variety of form and function." ‡ When parts are repeated in the same animal, not from right to left, but from before backwards, either on the middle line of the body, as the vertebræ or sternal pieces, or on the same side, as the ribs, such parts are homologous, but not in the same sense as when they are repeated in different animals; in the first case he calls them *homotypes* and in the second *homologues*.

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* Archetype and Homologies of the Vertebrate Skeleton. London, 1848. p. 166.

† Am. Journal of Science. Vol. XXVII, p. 157, 1864. See also Vol. LXI, p. 154, 1866. See also Wilder *op. cit.* p. 9.

‡ Archetype and Homologies of Vertebrate Skeletons. p. 7.

As a general rule, homologous parts resemble each other in form and uses, and by these are easily recognized. But there are instances in which form and use are insufficient for the determination of the homology of a given part. The "prickly pear" (*Opuntia*) which has the appearance of being all leaves, is in reality all stem, and this has not only the form but the function of leaves. Two homologous bones from different animals may be so unlike that an anatomist might be excused for taking them for different parts; and on the other hand, two different parts may be so nearly alike that were one not on his guard they would be considered homologous. Even Cuvier, in his earlier days, mistook the coracoid of a turtle for the scapula, on account of its shape.* Among teeth, molars and premolars interchange forms. Even here Cuvier was misled by this circumstance and described the large back teeth of the feline carnivora as true molars. Owen has shown that these supposed molars were the successors of deciduous teeth and therefore premolars. Human anatomists have generally misunderstood the homology of the articulating surfaces of the atlas and the upper part of the axis; and from their use have described them as if they were " articulating processes," while in man and most mammals, these processes do not exist in the vertebræ mentioned. True, articulating processes are found in the Cetacea, and some birds and reptiles, co-existing with the articulating surfaces above mentioned, and occupying the true position of articulating processes which the "surfaces" do not. We might extend the list of such instances, but it is unnecessary.

As the form and use of a given part under certain circumstances may leave us in doubt as to its homology, we need some other guide. This may be found, as Geoffroy St. Hilaire long since pointed out, in the relative position. The tusks of the elephant and mastodon are only known to be incisors by their position in the intermaxillary bones, and the radius and ulna of *Icthyosaurus* and *Plesiosaurus* are identified by their relation to the humerus and carpus, and not by their forms or uses. Had these been the only parts of the above mentioned animals which had been discovered, naturalists would have hardly suspected them to be ulna and radius. So in the determination of homotypes we are not to expect precise similarity of forms, as these are liable to differences analogous to those of homologues, as is especially the case in the carpus and tarsus.

If we are justified in accepting the conclusions set forth in this paper, then by an application of them the homotypes in the two limbs may be readily determined, for *those parts will be homotypes which have the same relative position, and are symmetrically placed with regard to each other.*

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* Leçons sur l'Anat. Comp. 1^{re} édit. T. I, p. 252.

Scapular and Pelvic Arches. The *general* homology of these has attracted less attention than the determination of the corresponding parts of the two with each other. Oken, Spix and Carus, considered them as ribs, and in this respect have been followed by Owen, who has presented his views with much more precision than his predecessors. Admitting them to be specially modified ribs, to what vertebræ do they belong? The pelvic arch has been assigned with much unanimity to the sacral vertebræ in the immediate neighborhood of which it always is; but the scapular arch offers a much more difficult problem, since in the three higher classes of vertebrates, the vertebræ near which it is found are all provided with ribs, and in many animals all the cervical vertebræ are rib-bearing, independently of the arch in question. Spix, who has been followed by Owen, regards this as being made up of the ribs of the occipital vertebra, and Owen urges in confirmation of this view, that in fishes the scapular arch is an appendage to the occiput.

The objections to this view, though we are not sure but that they are more apparent than real, are, first, that in only one of the four classes of vertebrates, viz., fishes, would the arch be found, so to speak, in its normal place; second, each such rib in the larger portion of the vertebrate series higher than fishes, would be provided with two "cartilages" or "hæmapophyses," viz., the coracoid and clavicle. This same difficulty presents itself in connection with the pelvic ribs, since these would also have two cartilages, the ischium and pubes. Third, the objection urged by Agassiz appears to have much weight. He objects that this arch and the limbs supported by it, derive their nerves in all classes from the spinal, not from the cranial series, while the reverse should be the case if they were truly cranial ribs. A branch of the vagus, or of the lateral nerve formed by the union of the vagus and trigeminus is, it is true, distributed to the scapular arch in addition to its spinal pairs. This, however, would not make the scapular arch an appendage to the head, any more than it does the trunk or even the tail to which this same nerve sends branches in fishes and Urodel batrachian reptiles.

In view of these objections one cannot but feel that additional evidence is needed, especially that to be derived from embryology, before definite conclusions can be reached. Extensive observations on the development of the scapular and pelvic arches may be expected to throw much light upon this problem. We have studied the development of the pelvis in frogs, and find that this does not take place after the manner of ribs. In the tadpole of the Bull-frog (*Rana pipiens*, L.)

the first trace of the pelvis consists of a plate of cartilage situated on the median line in front, and which corresponds in position with the future ischium and pubes. This cartilage subsequently becomes extended on either side, and at last forms a connection with the transverse processes of the sacral vertebræ. Its first stage, it will be seen, corresponds very nearly with the permanent condition of the pelvis in most fishes. In Cetaceans, the pelvis consists of ischia, or ischia and the bones of the pubes alone; the ilia do not exist. This would seem to be an indication that in mammals the development of this part followed the same course, as in frogs and fishes; that is, it begins its development on the median line in front.

In most vertebrates the *special* homology of these arches is more obvious, though somewhat masked, since the physiological requirements of the two differ so widely; strength and solidity being essential conditions in the pelvis and mobility in the shoulder. If, however, they are compared in those animals whose habits are more strictly aquatic, and whose locomotion is effected more nearly equally by the fore and hind limbs, as, for example, in the *Ornithorhynchus* among mammals, and the marine saurians among reptiles, the scapular arch, in consequence of the greater development of the coracoids, and of the union of these as well as of the clavicles with the sternum, or with each other, will be found to have almost the firmness of a pelvis. On the other hand the attachment of the pelvis to the vertebral column may become comparatively slight. In the chameleon the pelvis is nearly as moveable as the scapular arch, and in the *Icthyosaurus* it appears to have been entirely free, and to have embraced the ribs behind as the scapular arch does in front. (See Cuvier's Oss. Foss. Pl. 260.) Although the two arches never repeat each other exactly in one and the same animal, they do sufficiently to show that they are constructed upon one and the same plan. The scapular arch of one animal, however, often very nearly resembles the pelvic arch of another, as, for example, the first taken from a frog, Fig. 7, when compared with the second taken from a chameleon, Fig. 8, but in the *Enaliosaurians* the resemblance of these parts in the same individuals is still more striking.

As each arch consists of three pieces, the first step is to determine which are the corresponding ones. Vicq d'Azyr comparing bones from opposite sides, Gerdy, Bourgery, Blandin, Flourens, Cruveilhier, and Owen* comparing those of the same side, agree in considering the ilium as the serial homologue or homotype of the scapula, the pubes of the clavicle and the ischium of the coracoid.

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* "I commence with ilium as being the homotype or correlative of the scapula in the fore limb. The ischium, which is the homotype of the coracoid, is confluent with the ilium, as the coracoid is with the scapula; the pubes, which is the homotype of the clavicle, is confluent with both ilium and ischium." Philos. Trans., 1859, p. 809.

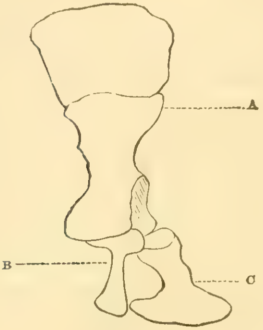

Fig. 7.

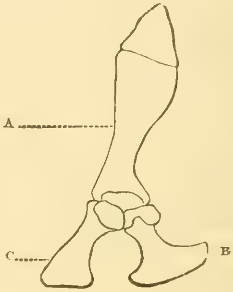

Fig. 8.

Fig. 7. Scapular arch of a frog. A, scapula; B, clavicle; C, coracoid.
Fig. 8. Pelvis of a chameleon. A, ilium; B, ischium; C, pubes.

Charles Martins compares the bones of the two arches in the following manner; "The reader may place the shoulder of one side reversed over the ilium of the opposite; or what amounts to the same thing, he may place on his left an ilium of the right side, and on his right the reversed scapula of the same side. The outer surfaces of the two bones will then be opposite to him, and may be studied in this position, the spectator being between the two."* Any one who will follow his directions with the bones in his hands, will find that the two ways above mentioned do not amount to the same thing. In the first method, the glenoid and cotyloid cavities will face in the same direction, and in the second in opposite directions. In the last these positions will be symmetrical, but not in the first. After comparing the axillary border of the scapula with the inguinal border of the ilium, the coracoid with the ischium, and the clavicle with the pubes, he concludes as follows: "En resumé l'homologie de l'epaule et du bassin me parait compléte. Un ceinture massive, soudée a la colonne vertebrale, se'st renversée et transformée en un appareil leger et mobile suspendu dans les chairs."†

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* Nouvelle Comparaison des Membres Pelviens et Thoraciques chez l'homme et chez les Mammifères. Par Charles Martins. Extrait des Mém. de l'Acad. des Sciences de Montpellier. T. III. p. 515.

† Ibid. p. 518.

If it be true, as he says, that the shoulder is the pelvis reversed, then it follows that the part of the latter which is farthest backwards, viz., the ischium, would be repeated in the shoulder by the clavicle, which is farthest forwards. This arrangement of the parts would be in accordance with the idea of symmetry, and with which M. Martins' description certainly does not agree.

Mr. Humphrey's determination of the parts, though based upon use and not upon the idea of symmetry, is strictly in accordance with it; the hinder edge of the scapula, according to him, being repeated in the fore edge of the ilium, the coracoid in the pubes, and the clavicle in the ischium.

Foltz adopts a method of viewing these parts quite different to that of either of the authorities alluded to above, but not unlike that made use of by Cruveilhier, and also by Martins, as will be seen further on, who compare a portion of one and the same bone in one limb, to two different bones in the other. The body of the pubes, according to Foltz, corresponds with the coracoid process of the scapula, while the descending branch corresponds with the clavicle.* He seems to overlook the fact that the body and descending branch are all of one piece, are ossified from a single centre, and never show themselves in any other way. Under these circumstances they cannot be considered other than as parts of one and the same bone, unless all ideas of the individuality of bones are abandoned. Following the principles of symmetrical development already laid down, the homologous parts will stand as follows:—

Scapula, Fig. 6,	A.	Ilium, Fig. 7,	A.
Clavicle, "	B.	Ischium, "	B.
Coracoid, "	C.	Pubes, "	C.

Limbs. The *general* homology of limbs, as has also been the case with the scapular and pelvic arches, has attracted much less attention than the special. Oken regarded them as "liberated ribs." In this view he has had but few followers, though Maclise in the article "Skeleton" in the Cyclopædia of Anatomy and Physiology, advocates somewhat at length a similar interpretation of these parts. Limbs are more commonly spoken of as "appendages" to their respective arches, and as "diverging appendages" by Owen, who at the same time considers them as serially homologous with the "oblique processes" on the ribs of birds, crocodiles and most fishes. With regard to the oblique processes just referred to, he suggests that while such rudimentary limbs in these animals never come to be more than spines attached to the edges of the ribs in the actual vertebrates, they might possibly under other circumstances, or in other worlds, rise to the dignity of perfect limbs. The possibilities of the vertebrate archetype may not as yet have been exhausted.* It does not appear, however, that the processes in question ever take on in the actual vertebrates an approach to a form which might be considered a limb, and it might be urged as an objection to Prof. Owen's view, that in fishes they seem to be an integral part of the muscular system, and that in neither fishes, reptiles or birds, do they occupy a position homologous with that of limbs, viz., at the junction of the rib with its cartilage, or of the pleurapophysis with its hæmapophysis.

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* Homologie des Membres Pelviens et Thoraciques. Par le Docteur Foltz. Journal de Physiologie. Paris, 1863. T. vi, p. 53.

It is unfortunate that in the attempts to determine the *general* homology of limbs so little attention has been given to their development, which is indispensable to the complete solution of the question. On studying their transitional phases in the embryo, we are, first of all, struck with the fact that in their primary conditions limbs have so strong a resemblance to the median fins of fishes and the flukes of cetaceans. The fins on the median line in fishes all agree in this, that they appear as an outgrowth from the integuments, in the form of a ridge extending continuously along the back, around and under the tail. This ridge is a mass of embryonic cells, all alike, but which subsequently become differentiated into fin-rays and other structures. The fin-rays are secondary structures, and cannot therefore be said, as has sometimes been asserted, to push out from beneath and carry the integuments with them. The adipose fin of the Salmonidæ permanently retains an early embryonic condition, and no fin-rays are formed at any period. The fore and hind limbs, in like manner, are outgrowths of the tegumentary cells, and for a time the cells undergo no differentiation into bones or other tissues. These are, at length, developed *in* the limbs, and subsequently grow *pari passu* with them. The bones do not, therefore, force the integuments out by their protrusion, but the integuments themselves have already grown out, and the limb is formed before the bones are developed. Limbs in their primary condition do not appear to be dependences of the scapular and pelvic arches, any more than the median fins of fishes, or the flukes of cetaceans, which last have sometimes been compared to limbs, are dependences of the vertebral column, or teeth are dependences of the jaws with which, notwithstanding their totally different origin, they become so intimately united at last. In view of the above considerations, and in view of the fact, also, that in fishes the ventral fins never pass beyond the condition of appendages to the integuments, we believe there is ground for the hypothesis that limbs belong to the category of tegumentary organs, and that their connection with the vertebral column through the scapular and pelvic arches is only secondary, as is that of the teeth with the jaws.

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* On the Archetype and Homologies of the Vertebrate Skeleton. London, 1848. p. 102.

HUMERUS AND FEMUR.

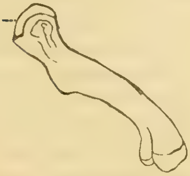

Fig. 9.

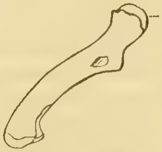

Fig. 10.

Fig. 9. Femur of an alligator. **Fig. 10. Humerus of an alligator.**

All agree that these two are homotypes, the only question is whether they are to be compared as parallel or as symmetrical bones; this answered, the parts which correspond are easily determined. As has already been stated, the majority of anatomists describe them as parallel repetitions. One of the difficulties which is encountered in this mode, is the fact that the knees and elbows in all animals are bent so as to form angles pointing in opposite directions. To meet this, Vicq d'Azyr, in comparing the limbs, turned the elbow forwards, but in doing so the head of the humerus was found to face in one direction, and that of the femur in the opposite one. He then compared the limbs of opposite sides; in this case, not only was the limb placed in an unnatural position, but although the heads of the bones faced in the same direction, the thumb was on one side of the hand, and the great toe on the other side of the foot. He simply exchanged asymmetry of the heads of the humerus and femur for asymmetry of hands and feet, and so the difficulty was not obviated. Maclise, in his article "Skeleton," in the Cyclopædia of Anatomy and Physiology, and Martins in his Memoir, meet this difficulty by supposing the humerus twisted through 180°. "In primitive construction both members are identical, but this secondary modification, viz., the torsion of the humerus, is that circumstance which distinguishes them one from the other. While in idea I untwist the humerus, by bringing its back to the front, I at the same time unravel the gordian knot of that problem which has so long existed as a mystery for the homologist." * According to Martins, "the femur is straight and has no torsion. The humerus being a twisted femur, if we wish to compare the two, it is first of all necessary to untwist it (*detordre l'humerus*) the effect of which is to place the epitrochlea (inner condyle) outwards, and the epicondyle (outer condyle) inwards. This done, the comparison of the pelvic and thoracic extremities offers no further difficulty." * That this does not quite clear up the matter even to M. Martins, appears a little further on, where he admits what he calls a "metaphysical difficulty" (*difficulté metaphysique*), viz., that the humerus never was literally twisted; "it is a virtual torsion, which was never mechanically effected"; "but this virtual torsion has produced all the consequences of a real one." † In another place he informs us that "L'humerus n'est point un os d'abord droit, qui se torde ensuite. Il y a mieux l'humerus est tordu avant d'exister."! In order to put the bone in the untwisted condition he supposes it plastic, as when the lime has been removed by acid, or, to make a mechanical illustration practicable, he cuts the bone in two, puts a peg in the medullary cavity and rotates the lower half 180°. Any one, however, who will take an arm from an articulated skeleton, place the palm on the table, and then following his directions in imagination, or by the mechanical process, and rotates the humerus 180° from within outwards, (the direction necessary to untwist it) he will find a real, and not a metaphysical difficulty. In the ordinary prone position of the hand, the radius is already partly wound around the ulna, and will completely encircle it when the humerus is "untwisted," thus producing a much greater distortion than the one attempted to be obviated. Mr. Humphrey has already pointed out other difficulties in the way of this view of Martins, and we will only add that the lines supposed to indicate torsion simply grow out of the mode of attachment of the muscles to the bone, and in no way indicate a twisting of it. The bone primarily was smooth, and the ridges were built up on it as the muscles themselves were developed, without the ends of the bones having in any way changed their relative position.

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* Cyclop. Anat. and Physiol. Article Skeleton, p. 666.

If the two bones are supposed to be symmetrical repetitions, no difficulties arise. They will have the position which is natural to them in the animal series; the axis of the humerus will incline backwards, and that of the femur forwards. The articulating convex surfaces of the lower end of the humerus will face forwards, while those of the femur will face backwards. The back of the humerus, which is on the side of the extensor muscles of the fore arm, will be opposed to that part of the thigh which is on the side of the extensor muscles of the leg.

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* Memoir, p. 482. † Idem, p. 490.

FORE-ARM AND LEG.

No portions of the limbs have given rise to more widely differing opinions than these, and it is in connection with them that nearly all the discussion of the homologies of the parts of the limbs have been made. Vicq d'Azyr, comparing opposite sides, considers the tibia as the homotype of the ulna, the fibula of the radius, and the patella of the olecranon. Meckel and others homologize the same parts, but compare limbs of the same side. Gerdy, on the other hand, compares the radius and tibia, the ulna and fibula, but asserts at the same time that the olecranon and patella are homotypes, in which case it is obvious that the patella should be attached to the fibula. He gets over this difficulty by assuming that its union with the tibia is an "anomaly."

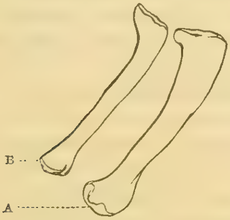

Fig. 11.

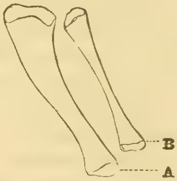

Fig. 12.

Fig. 11. **Bones of the fore arm of an alligator. A, ulna; B, radius.**
Fig. 12. **Bones of the leg of an alligator. A, tibia; B, fibula.**

Bourgery, and more recently Cruveilhier, seeking for a solution of the question by studying only the resemblances in the form and uses of parts. adopted the singular "*hypothése de croisement*," which Cruveilhier states as follows:—

"1st. No bone of the leg singly represents one of the bones of the fore arms.

"2d. In each of the bones of the leg we find characters, some of which belong to the ulna, and some to the radius.

"3d. We admit that the upper end of the tibia is represented by the upper end of the ulna, and the lower half of the tibia by the lower half of the radius; while the fibula is represented by the upper half of the radius, and the lower half of the ulna."*

Martins homologizes the parts in question as follows: "The femoral end of the tibia in Monadelph mammals is formed by the humeral heads of the radius and ulna." "The upper third of the fibula is represented by the anterior or coronoidal part of the ulna." "In all mammals the two lower thirds of the tibia represent the corresponding part of the radius, and the two lower thirds of the fibula that of the ulna." *

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* Traité d'Anatomie Descriptive. Paris, 1843. T. I., p. 342.

The view of Prof. Owen is as follows: "The skeleton of the Phalangista or Phascolomys plainly demonstrates that the tibia is the homotype of the radius, and that the fibula is the homotype of the ulna."† The same conclusions are adopted by Humphrey.

Thus putting together the views of the anatomists above cited, we have:

1st. The ulna = the tibia of the opposite side.
2d. The ulna = the tibia of the same side.
3d. The ulna = the fibula.
4th. The head of the tibia = the heads of the radius and ulna.
The fibula = the coronoidal and lower two-thirds of the ulna.
The lower two-thirds of the tibia = the corresponding part of the radius.
5th. The tibia = the upper half of the ulna and the lower half of the radius.
The fibula = the upper half of the radius and the lower half of the ulna.

There seems to be no sufficient reason for entering into a discussion of the views of those who consider a bone of one limb homologous with parts of two different bones in another. We do not know of any unquestioned analogy in the whole range of comparative anatomy which can be brought forward in support of it.

Prof. Owen sustains his opinion, already cited, by the following statement, and in this he is followed by Humphrey and others: "In the Wombat the part of the fibula representing the olecranon is a detached sesamoid, as the olecranon itself is in the penguin and the bat. In the *Ornithorhynchus* the fibula (Fig. 14, B) assumes the proportions and develops the process from its proximal end, the want of which in man and most mammals, deceived Vicq d'Azyr as it misled, more recently, M. Cruveilhier."

We are somewhat at a loss to know what is to be understood by the expression "detached sesamoid," inasmuch as a sesamoid, as commonly understood by anatomists, is always detached. The only interpretation which suggests itself to us is, that it is used synonomously with an epiphysis, and that the bone connected with the upper end of the fibula in the Wombat is the detached epiphysis of that bone, and this he considers homologous with the large process on the upper end of the fibula of the Monotremes. No evidence is brought forward to prove that the sesamoid referred to is in any way different from the bones found in tendons in other parts of the body, as *e.g.*, in the heads of the gastrocnemius of the opossums, and also of many rodents, and in the flexor tendons of the fingers and toes of many mammals, in the peroneus longus in man, and as an anomaly in the tendon of the human biceps cruris near its insertion into the fibula. Furthermore, the part in question can hardly be considered as a detached epiphysis, since in those animals where a sesamoid is developed in the tendon over the head of the fibula, the normal epiphysis exists in the bone itself.

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* Mem. Acad. Sciences. Montpellier, T. III, p. 535.

† Archetype and Homologies of the Vertebrate Skeleton. London, 1848, p. 167.

In the Penguin it does not appear that the part corresponding to the olecranon is of any less size than in other birds, although the sesamoid bones, which Prof. Owen supposes replace this process, are present. In the arm of a large Pteropus we have found the patella-like bone attached to the ulna by a ligament, as the patella is attached to the tibia. The ulna, however, has a projection at its upper end of about the same size as the olecranon in birds. But before this patella-like bone can be claimed to be a detached epiphysis, it must be ascertained whether the ulna has, or has not, an epiphysis in the immature bone. In many of the anatomical descriptions of the ulna, the olecranon process and the epiphysis have been described as if they were the same thing, which most certainly they are not. In mammals the olecranon is often much longer than in man, the epiphysis forming but a very small part of it, and in man is only a very thin scale covering its end. Properly speaking, the olecranon is a continuation of the shaft of the ulna. The cartilage of ossification interposed between the shaft and the epiphysis is remarkably thick, and has given rise to the belief that this was itself the epiphysis. The last only forms at a late period.

As to the argument drawn from the great development of the process on the top of the fibula in the *Ornithorhynchus*, it seems to us that this is an instance in which we are liable to be misled by form, and that the resemblance between the process in question and the olecranon is no proof of homology. It should be remembered that processes, and even bones, in different animals, are liable to every degree of variation according to the physiological requirements in individual cases. Compare the extraordinary processes of the humerus of the Mole, the Mylodon, or of the Ant-eaters, with the diminutive ones of the same bone in the Three-toed Sloth, the Cetaceans, or of the marine Saurian reptiles. The olecranon itself is a very variable process; it does not exist in Cetaceans, is hardly apparent in birds and most reptiles, but in mammals may become, as in the great Armadillo, almost half as long as the whole ulna. This development is in relation to the extensor muscles of the fore arm. The remarkable development of the fibula in the *Ornithorhynchus* may justly be compared with the great development of the olecranon in the Armadillo or the Mole, as a means of increasing the power of the particular muscles attached to it, but this resemblance is physiological only, and has no bearing whatever on its homology. The head of the fibula in the *Ornithorhynchus* is, however, not developed in relation to the extensor muscles of the leg, but of some of the unusually large muscles of the foot, which take their origin from it; viz., the large head of the gastrocnemius, the soleus, the two peroneal muscles, the common flexor of the toes, the long extensor of the great toe, the common extensors of the toes and posterior tibial muscle, but has not that relation to the muscles of the leg which the olecranon has to those of the fore arm. The mere form of the process of the fibula is no proof that the fibula and ulna are homotypes, although in many respects it resembles an olecranon. (Fig. 14, B.) The prolonged upper end of the tibia in

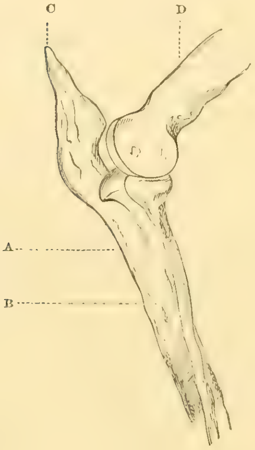

Fig. 13.

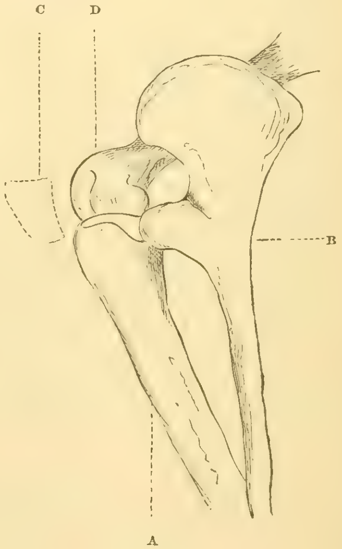

Fig. 14.

Fig. 13. From a grebe. A, tibia; B. fibula; C, upper end of tibia prolonged so as to form a process analogous to the olecranon; D, femur.

Fig. 14. From an Ornithorhynchus. A, tibia; B, fibula, with a process analogous to an olecranon; C, patella; D, femur.

the Grebes (Fig. 13, C), Loons, Penguins, Gannets, etc., can be brought forward with far more force to show that the tibia is the homotype of the ulna, for, in addition to its resemblance to an olecranon in form, "it affords extensive attachments by way of insertion to the extensors of the tibia,"* which the fibula does not.

If the fibula is the homotype of the ulna, then it follows that the flexor muscles of the leg, which are inserted into the upper end of it, are the homotypes of the extensor muscles of the fore arm, which are inserted into the olecranon; with this comes another difficulty growing out of the fact that the internal angle formed by the leg and thigh, and which is on the side of flexion, corresponds with, or is the homotype of, the external angle formed by the arms and fore arm, which is on the side of extension.

Prof. Owen derives additional support to his view as to the homology of the ulna and fibula, from the mode of articulation in some animals of the tibia with the fibula, as compared with that of the ulna and radius. "The correspondence of the fibula with the ulna is very remarkably maintained in the *Petaurus taguanoides*, in which the proximal articular surface of the fibula is divided into two facets, one playing upon the outer condyle of the femur, the other concave vertical and receiving an adapted convexity on the outer end of the head of the tibia, which rotates thereupon exactly like the radius in the lesser sigmoid cavity of the ulna."†

In connection with this statement it may be remarked that as regards the articulation of the fibula with the femur, it is the exception among mammals to find it coming in contact with that bone, but even in Monotremes, Birds and Reptiles, the extent of its articulation with the femur is always secondary to that of the tibia, and never becomes as extensively articulated with it as the ulna does with the humerus. As regards the rotation of one bone on the other, we have found, after a careful examination of the parts in an *Ornithorhynchus* which, through the kindness of Prof. Agassiz, we have recently had an opportunity to dissect, that it is the fibula which rotates, while the tibia is fixed, and in this respect the latter more nearly resembles the ulna. The fibula in the *Petaurista* resembles the ulna in having a sigmoid notch. This cannot be considered as a decisive character, when it is remembered that the articulating surface of the lower jaw is convex in mammals, but concave in other vertebrates; the lower jaw does not in consequence change its homology in these last.

Admitting all the arguments which have been adduced to prove the fibula to be the homotype of the ulna, we have still another and greater difficulty than any thus far mentioned, growing out of its rel-

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* Owen Cyclop. Anat. and Physiol. Vol. I, p. 287.

† Cyclop. Anat. and Physical. Art. Marsupialia. p. 285.

ative position. For of all the means of determining homologies, this is the most trustworthy. If the two bones of the fore arm and of the leg are placed in planes at right angles to the axis of the body, those bones must be considered homotypes, which occupy corresponding positions. The bone on the outside of the fore arm, viz., the radius, can only be the homotype of that on the outside of the leg, viz., the fibula. But few anatomists have made any allowance for the pronation of the fore arm, and most of them overlook the fact that the proper position of the bones of this segment for comparison with those of the leg, is supination. If the position of pronation is to be retained for the fore arm, the leg should go through a corresponding rotation in the opposite direction. Viewed in connection with the idea of symmetry, the homotypes are determined without difficulty, and are as follows:—

The Radius is homologous with the Fibula.

The Ulna is homologous with the Tibia.

THE PATELLA.

By Vicq d'Azyr, who has been followed by Meckel, Blainville, Martins, Humphrey and others, this bone has been regarded as the homotype of the olecranon, differing from it, however, in being attached to bone by a ligament. Soemmering, who has been followed by Bertin Bichat, Flourens, Owen and Cruveilhier, maintains that the patella belongs to the class of sesamoid bones, and therefore, properly speaking, does not belong to the skeleton at all.

We believe the latter view to be the correct one, for the same reason, that the separate bone in the leg of the Wombat, already referred to, is a true sesamoid, and not a detached epiphysis of the fibula. Mr. Humphrey, like the others, who regard the radius as the homotype of the tibia, and the olecranon as the homotype of the patella, is obliged to meet the difficulty which arises from the connection of the patella with the tibia, when, if it were the homotype of the olecranon, it should be connected with the fibula. Mr. Humphrey admits the possibility of a part of a bone, an epiphysis, being detached, and of becoming connected with another, and sustains his statement by the analogy of the ribs, which, he says, may be transferred from the upper to the lower transverse process, or *vice versa*.* This does not seem to be an analogous case; for, in point of fact, the typical rib is attached to both, as, for example, in the foremost ribs of the alligator, and either the upper or lower attachment may become obsolete, without really shifting the relation of the ribs to the vertebra. There is not a single unequivocal instance in the whole range of comparative anatomy, of an epiphysis undergoing such a displacement as is claimed for the patella.

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* Memoir, p. 20.

There are some facts, however, which seem to support the view under discussion. The researches of Robin have set at rest the question as to the nature of the odontoid process of the axis, and have proved that it is the body of the atlas coössified with that of the axis. This, however, would not be similar to the transfer of the epiphysis of one bone to the shaft of another *parallel* to it. The bodies of the vertebræ are in a *linear series*, and may be united without changing their relative position, as happens, for example, with the occiput and sphenoid, or with the epiphyses of the sacral vertebræ which may become united with each other before either of them becomes united with their respective bodies. The epiphyses of the ulna and radius in some ruminants, as the ox, may become coössified with each other before they are coössified with their shafts. But in all such cases the relative position of parts is strictly preserved, and there is consequently no transfer of an epiphysis from one bone to another, as is required by the hypothesis which is referred to above. We therefore conclude that the view of Soemmering and others, which regards the patella as a sesamoid, is the more reasonable.

HANDS AND FEET.

Admitting the existence of fore and hind symmetry, no difficulty is met with in comparing either the pelvic or scapular arches, the humerus and femur, or the bones of the fore arm and leg, provided the bones of the fore arm are rotated outwards enough to counteract the rotation inwards which took place in fœtal life. If we would compare hands and feet as symmetrical parts, the first step should be to put them in symmetrical positions. For this purpose suspend a human skeleton with the vertebral column horizontal, allow the legs and arms to hang vertically from it, and rotate the fore arm completely outward. The palms will now face forwards, and the soles backwards, the bones of the fore arm and leg will be in parallel planes, and these at right angles to the axis of the body. If now the foot is raised forwards, so that the sole shall be horizontal and at right angles with the leg, the hands should be raised backwards to the same position with regard to the fore arm; the fingers will now point backwards, and the toes forwards, and thus the general symmetry of all the segments of the limbs is secured. It is in this that the limbs of man and animals would have ended in the process of development, had not the tendency to symmetry been interfered with, for the purpose of adapting the skeleton to the different kinds of locomotion.

While the homology of tarsal and carpal bones, as groups, is obvious, that of individual bones is quite difficult to determine. The fact that in mammals the bones of these two groups are not conformably placed in the two limbs, and in addition to this the constant variations in the vertebrate series of the form and number of the pieces, sometimes reduced to two, as in the tarsus of a frog, and sometimes increased to eleven, as in the carpus of the armadillo, renders the probability of a satisfactory result being reached in the direction of special homology well-nigh hopeless. The homologies, in man and mammals, of the individual bones in the tarsus and carpus hitherto determined, rest largely on their physiological correspondence. The pisiform and the calcaneum, for example, are regarded as homotypes, because each, in certain animals, as the *Carnivora*, has a large tuberosity, and each is a lever for increasing the muscular power applied to the motions of the foot. But in these animals they are highly specialized parts, and are the farthest removed from the typical conditions which are most generally the best represented in the lowest animals of a given group. If anatomists had begun their studies with reptiles, such as Plesiosaurus and Icthyosaurus, or with lizards and turtles, the homologies now generally recognized would not have been so persistently brought forward.

The mammalian foot, which connects with the leg solely by the astragalus, gives one quite a different idea of the tarsus and its relations, from that derived from the same segment in reptiles, where, for the most part, the astragalus articulates chiefly with the tibia, the os calcis with the fibula, and a third bone is interposed between them. Furthermore, the os calcis, which is so highly specialized in mammals as to be distinguished at sight, has in reptiles the appearance of the other tarsal pieces, and resembles a cuneiform bone. Even in mammals the pisiform, as in man, is so reduced that it becomes relatively insignificant, which circumstance, and its relation to the tendon of the ulnar flexor, led Cruveilhier to class it among the sesamoid bones.

In the ideal vertebrate skeleton the tarsal and carpal bones having no special development, would be represented by two rows of polygonal or circular discs, all alike, as is actually the case in the marine saurians. Reducing all the bones in question to one and the same form, as in the lowest groups, form would cease to be a guide to the determination of the homology of any particular bone of the tarsal or carpal series. Those parts will be homologous which occupy similar and symmetrical positions; the inner bone of the wrist articulating with the ulna, will be homologous, or the homotype of the inner bone of the tarsus articulating with the tibia; or in other words, homologous bones are determined by the principle of symmetry and relative position, and not by their teleological relations.

Making use of this principle, we shall have the following bones in the two limbs homologous; beginning on the inside:—

HAND.	FOOT.
Pisiform	
Pyramidale	Scaphoid.
Lunare	Os calcis.
Scaphoid	Astragalus.
Unciform	1st cuneiform.
Magnum	2d cuneiform.
Trapezoid	3d cuneiform.
Trapezium.	Cuboid.

When applied to the human hand and foot with their high degree of specialization, this mode of comparison seems at first sight inadmissible, but bearing in mind the fact that the type is much more distinctly indicated in the lower, than the higher members of a series, and beginning our comparisons in the lowest, the difficulties growing out of the special developments are obviated. It will be found that in reptiles the tarsus, for the most part, articulates with the leg by two, and even three, bones instead of by one, as in ordinary mammalia; that the astragalus and os calcis neither of them have the peculiar characters which are exhibited in the higher vertebrates, while in the seals among mammals the astragalus develops a tuberosity backwards equal to that of the os calcis of the same animal.

We have placed no bone opposite the pisiform as its homologue. Some homologists, and among them Owen, regard the os calcis as, in itself, repeating the pisiform and pyramidale, and as consisting really of two bones combined in one, as the scaphoid and lunare are in the carpus of the cat and some other mammals. This view does not seem to be well supported; for while the coalescence of the scaphoid and lunare in various animals is a matter of observation, the existence of an os calcis in two parts has not been observed in any. In its mode of ossification, except in the development of a thin scale on the end of its tuberosity, it follows that of the other tarsal bones, viz., from a single centre. And in having an epiphysis it agrees with the astragalus in some lower animals, as the seal. The relation of the pisiform to the tendon of the "ulnar flexor" (extensor) of the wrist seems to justify Cruveilhier's view that it belongs to the category of sesamoids.

The metacarpal and metatarsal bones offer no difficulty in either of the two methods of studying the skeleton, since they agree in their relative position, and the only differences are purely teleological ones. Excepting in the thumb and great toe the same may be said of the phalanges. We have already alluded to the great difficulty which the exceptions just mentioned offer when the limbs are studied as symmet rical parts, and we know of no way in which it can be fairly and satisfactorily met.

The thumb and great toe are assumed by most anatomists to be homotypes. First, on account of their relative size. Secondly, because they have similar relative positions in the ordinary attitude of the fore arm. Thirdly, and chiefly, because they have only two phalanges each, while each of the other digits has three or more.

If the human hand and foot are alone examined, the relative size of the parts in question favors the view that they are homotypes. But this characteristic of size loses its value when they are studied in the lower animals. In the seal the thumb might, as regards its size, be considered the homotype of either the first or the fifth toe, which are the two largest and of equal size. In the walrus the first digit of the hand and the fifth of the foot, or the thumb and little toe, are the largest in their respective limbs. In the great ant-eater the third digit of the hand is longest, while the fourth is in the foot. If size were the criterion of homology, either of the fingers might in turn become the homotype of either of the toes, for the size of these parts being determined by their physiological adaptations, either may in turn become the largest or the smallest in the series.

The second reason, that based on the fact that they are both on the inside of their respective limbs, loses its force when it is remembered that the parts compared are, as it were, in a false position. That but for the rotation of the fore arm in the embryo, the thumb would have been on the outside of the hand, and would consequently have conformed to the position of the little finger.

The third argument, derived from the existence of two phalanges in each of the parts, is not so easily disposed of, and forms the greatest difficulty in our way. Notwithstanding the wide difference in the physiological value of these parts in different species of animals, and the consequent range of variation in the size of them, the number of phalanges may be said to be almost constant. It is true that in *Ichthyosaurus*, *Plesiosaurus*, and other marine saurians, the thumb and great toe, like all the other digits, have their phalanges multiplied, and if our comparisons were confined to such animals as these the question of homologies would be easily answered, as it would also in some of the land turtles, where the number of the phalanges in all fingers and toes is reduced to two. If, too, we might apply the saying of Goethe, which holds true in so many instances, viz., "that it is in her monstrosities that nature reveals to us her secrets," we might call to mind an occasional monstrosity in which the thumb and great toe are each provided with three joints, and thus made to conform with the other digits. Lastly, we might call to mind the fact that in their mode of ossification, the metatarsal and metacarpal bones of the two parts in question agree with the phalanges, that is, in having the proximal epiphysis the last to unite with the shaft instead of the distal. Still the preponderance of facts is the other way, and, if we adopt the idea of symmetry, we must rest content with the assumption that the thumb with its two phalanges is the homotype of the outer toe with its three phalanges.

In the preceding pages the object has been to set forth some reasons for studying the fore and hind parts of vertebrated animals, but more especially their limbs, as if these parts and limbs were constructed not only after one and the same type, but in a symmetrical manner. They would repeat each other exactly in an ideal animal, just as the right and left parts do in the actual. In the actual animal the fore and hind parts are so modified as to adapt them to special conditions of existence, and as the conditions fulfilled by the two kinds of limbs are generally different, the limbs take on different degrees and phases of development. Right and left parts repeat each other almost exactly, because their conditions are the same, though even these, as we have already seen, may sometimes vary, and then we have a diversity in their development. In fore and hind limbs diversity is the rule, while in right and left it is the exception. Nevertheless, as we go back to the early stages of embryonic life, the symmetry and equality of fore and hind parts becomes nearly exact, however much they may vary in the adult.

We have not forgotten that in attempts like the present, comparisons should be made, not only between the bones of the limbs, but also between the muscles, nerves and vessels. We have confined our remarks chiefly to the bones, because their homologies are the most accurately determined. The attempts hitherto made for the determination of the homologies of the other parts, have been far less satisfactory. If a serious objection can be brought against the mode we have adopted of viewing the bones, far more serious objections can be brought against such a method of viewing the other structures. If the method fails in the skeleton, it will certainly fail elsewhere. On the other hand, if antero-posterior symmetry can be shown to exist in the bones, then we can feel some confidence, that whatever the difficulties at present may be with regard to the muscles, nerves and vessels, they will sooner or later be overcome. We may go still further, and assert that if the idea of fore and hind symmetry enters into the composition of animal structures at all, it will be traced not only in the limbs, but in all the great systems of organs. Unity of plan in the structure and composition of animals is much more likely to prove true than diversity.

Attempts have been made to construct an ideal skeleton, an "archetype" which is presumed to contain all the essential elementary parts of a vertebrated skeleton; these parts nowhere so developed as to be adapted to the wants of any individual, but capable, by a variation in the quantity and proportions of each, of being adapted to the conditions of life of every member of the series. Carus in his "Urtheilen des Knochen und Schalen gerüstes" attempted such an archetype. Owen in his "Homologies and Archetype of the Vertebrated Skeleton," has constructed another on essentially the same basis, but far more complete. Neither Carus nor Owen have, however, admitted the idea of fore and hind symmetry. If we admit this, then the archetype must be so modified as to conform to it. The typical structure which represents or occupies the place of the head at one end, if we will carry out the idea, must be represented by a similar reversed structure at the other. If, for example, we would adopt Owen's modification of Carus's archetype, we must divide it in the middle and replace the hinder half with a reversed repetition of the fore half. The skeleton would not in this way be provided with two heads, but only with the rudiments of these capable of being developed or arrested in development, in such a manner as the conditions of individual existence may require.

Whether we adopt the doctrine of fore and hind symmetry or not, such a conception as an archetype involves is necessary in our attempts to study the creative idea which underlies all animal structures, apart from their adaptation to the modes of existence in each species; and just in proportion as such a conception is based upon a more and more complete knowledge of the plan of structure and of development, anatomy will, in the same degree, become philosophical.

The Rev. Mr. Waterston exhibited two pillow-cases which had been in use in different families for some time; in both cases the feathers were stripped of their plumules and the filaments formed a plush-like nap of remarkable uniformity which adhered firmly to the whole interior of the case. The change appeared to have been a mechanical result of its long use. Several other instances were cited.

A letter from Professor Baird was read by the Secretary, giving an account of a proposed expedition to the island of Socorro, one of the Revillagigedos, two hundred and fifty miles west-south-west of Cape St. Lucas, S. California. It was undertaken by Col. A. J. Grayson under the auspices of the Smithsonian Institution; the coöperation of the Society was desired. The Secretary stated that the Council had already responded favorably and had forwarded the necessary funds.

Messrs. W. P. Cross, Wm. Sturgis Bigelow and F. P. Atkinson were elected Resident Members.

June 19, 1867.

The President in the chair. Thirty-one members present.

The Rev. R. C. Waterston announced the death of Thomas Bulfinch, Esq., formerly an officer of the Society, and gave an extended notice of his life and character.

As a mark of the deep respect in which the Society held their late member, Mr. Waterston was requested (on motion of Dr. Charles T. Jackson) to prepare a fitting tribute to be placed upon the Records; in response to which the following testimonial has been furnished.

TRIBUTE TO MR. BULFINCH.

By the sudden death of Thomas Bulfinch, who, after a brief illness, has been removed from the midst of honorable and useful activity, the whole community suffers a loss which will be widely and deeply felt. This Society, at such a time, would recall with gratitude the past services of their lamented associate, who, through many years, rendered valuable aid in the promotion of its interests. He was elected a member of the Society on the 3d of June, 1840, and was chosen its Recording Secretary on the 4th of May, 1842, which office he faithfully filled until May, 1848. Through these six years, the volume of records, upon the table before us, testifies to his conscientious fidelity. The account of every meeting, through that extended period, with the statement of each important measure proposed, and each scientific fact, stated or discussed, all elaborately written out with unfailing accuracy, proves how much he was able and willing to do in the cause of natural science, and the time and thought he cheerfully gave to promote the objects for which we are here associated. In addition to his labors as Recording Secretary, he was appointed (May, 1841) Curator of the State Collection of Mineralogy and Geology, which was at that time under the care of this Society.

While we fondly recall the modest and unassuming spirit of our friend, his manners, gentlemanly and courteous, his unwearied industry and scholarly methods of thought, let us pause for a moment, and briefly review the passing events of his life.

Thomas Bulfinch was born July 14, 1796, at Newton, Massachusetts, where his parents, whose home was in Boston, were temporarily residing. He was the second son of Charles Bulfinch, whose reputation as an architect, at that day stood among the highest in his profession; his name has become associated with the State House, that crowning object of this metropolis, and also with the National Capitol at Washington.

Mr. Bulfinch was fitted for college at the Boston Latin School and at Exeter Academy. Graduating from Harvard University in 1814, he numbered among his classmates, Prescott the historian, the Rev. Dr. Greenwood, the Rev. Dr. Lamson, and many others who have since filled prominent places, and left names which will be long remembered.

After leaving college, Mr. Bulfinch was chosen usher of the Latin school, then under the charge of his friend and classmate, Benjamin A. Gould, whose important labors in the cause of education exerted an influence felt to this day. Here Mr. Bulfinch remained fourteen months, when, feeling no very strong inclination for either of the professions, and the proclamation of peace (1816) reviving commerce and trade, he entered upon the active duties of a business life. Two years were thus spent in Boston, when he was led to remove to Washington, where his father was engaged as architect in the erection of the Capitol. Here he resided seven years, when, in 1825, he returned to Boston, entering into a business copartnership with his relative, Mr. Joseph Coolidge. This connection continued until 1832 when, after some other business experiences, he was chosen to a responsible position in the Merchants' Bank, which he held until the time of his death, a period of thirty years.

Devoted as he was to the duties devolving upon him as a man of business, he had tastes, aside from this, yet more congenial to his nature, which he followed with a quiet, but persistent enthusiasm. Thus it was that he became an active member of this society, and its Recording Secretary through six years. His favorite branches of study in natural history were mineralogy and geology. Not that he laid claim to any preëminence as an original investigator in those branches, but feeling a keen interest in such subjects, he was anxious to study and search as he might be able. Hence he greatly enjoyed the meetings of the Society, and intercourse with the many gifted and learned men with whom he thus became associated.

His mind balanced for a time between science and literature. There was that in both which awakened his admiration, and exerted an attractive power. At length, literature gained the ascendency, though science always continued to possess a peculiar charm.

We are all, to a certain extent, creatures of circumstance. He was not an exception to that rule. In 1850, King's Chapel (to which he was strongly attached) desired a revised edition of their liturgy, and Mr. Bulfinch was appointed to a participation in the work. In this connection he became deeply interested in the translation of the Psalms. This led to a continued study of Hebrew literature, some of the fruits of which he presented to the public in the first volume which he published, entitled "Hebrew Lyrical History," or select Psalms, arranged in the order of the events to which they relate, with introduction and notes.

Thus did he enter upon the career of authorship when about fifty years of age. The reception extended to this volume was so encouraging, that with his acquirements and highly cultivated tastes, he continued to use the pen which had proved its capability of doing such acceptable work. In 1855 he published "The Age of Fable," in which he relates the stories of Mythology, Greek and Roman, in a way to render them attractive to the lover of general literature, who, if not thoroughly acquainted with the classics, might thus be put in possession of valuable knowledge, in harmony, as far as was possible, with the charm of the original narrative.

This was followed, in 1858, by a volume on "The Age of Chivalry, or the Legends of King Arthur," presenting, in the same spirit, graphic pictures of a later age; opening to the reader treasures of poetic thought, and offering a golden key by which many of the allusions in modern literature, to ancient manners and customs, may be better understood. This work was followed, in 1863, by "The Legends of Charlemagne, or the Romance of the Middle Ages."

These productions appealed chiefly to the imagination, though they were the result of accurate study and laborious research. In addition to these, he entered upon the domain of history, in a volume entitled "Oregon and Eldorado," in which he gives an authentic account of remarkable expeditions and daring adventures, connected both with South and North America.

There were several works of less importance, all of which were the fruit of thought and care, written in hours rescued from the pressure of active business. Never was author more modest in regard to the merits of his own productions. Unpretending in his whole nature, he made no claim to any special gift of genius; but in harmony with a refined taste, and as the result of much quiet investigation, he wrote as a recreation to himself, what proved a source of pleasure and instruction to a large circle of readers. Now that he has gone, they remain a lasting witness to his industry, bearing testimony, not only to his general erudition, but to most beautiful traits of personal character. Not often, commencing at the age of fifty, has an author achieved so much, especially when the usual working hours of each day were conscientiously given to the demands of a most responsible business position.

But aside from this, Mr. Bulfinch devoted much time to social intercourse among a circle of friends who greatly appreciated his worth. Modest he was, but never morose, for a more genial or generous nature could not be found. Keenly sensitive to the gentler sympathies of life, he truly lived in his affections, and never was he weary of extending kindness, not only to companions and friends who valued his friendship, but to the needy and tried, young or old, wherever they might be.

Many instances have come to knowledge since his departure, of benefactions bestowed by him, and of service rendered, where self-denial and sacrifice were cheerfully met to accomplish the end.

One evidence, among many, of this feature of his character, was his interest in a young lad named Matthew Edwards, who came to this country poor, and almost without a friend, in the spring of 1853. Many young persons it had been Mr. Bulfinch's delight to encourage and assist in their efforts to obtain an education, and the same generous thoughtfulness led him to render service to this lad, at that time but fourteen years of age. The boy stated that, as an effectual way of disciplining his mind, and also to obtain the knowledge of an important language, he was very desirous of studying Latin. Mr. Bulfinch offered to devote one evening of every week to his instruction. To Latin was afterwards added algebra, and when these studies were finished, the remainder of each evening was devoted to reading. Had this continued but a few months, it would have been a noticeable fact, but through three successive years did Mr. Bulfinch voluntarily and gratuitously set apart these evenings for this purpose, yielding social privileges, and whatever might present itself, to the instruction of a poor and almost friendless lad. But this was not looked upon in the light of a sacrifice. His desire of doing good was so great, that the very act of doing it brought its reward; and his judgment was so accurate that he selected objects for his efforts which prevented disappointment. Matthew Edwards proved to be a youth of extraordinary ability, with mental powers only too active for his physical strength, an energy and perseverance which worked themselves to exhaustion; and possessing, in connection with this, a beauty of character which won every affection of the heart. Mr. Bulfinch became intensely interested in his welfare, and what he did for him was an illustration of his own character. The sudden death of this interesting youth in December, 1859, fell as a heavy blow upon his friend and benefactor. Mr. Bulfinch could not have watched over an only son more tenderly; and when he was taken away, his grave was made in the family lot of Mr. Bulfinch at Mount Auburn, with the request that when his time of departure should come, they might rest side by side. And so it is, that at this moment, that which was mortal of teacher and pupil rest together in that beautiful garden of graves.

I know not a more touching friendship, or an incident more strikingly beautiful in all the history of Christian benevolence.

Much more might be said of Mr. Bulfinch, but it is not needed. His excellences were familiar to you all. His quiet and respectful manner, his gentlemanly consideration, his conscientious fidelity, his love of learning, his Christian trust and faith, these were an indissoluble part of himself.

He had rounded out seventy years, yet who that saw his youthful freshness would have imagined that he had arrived at so advanced a period. Incredible it seems, — yet how worthily were those years employed; crowded with kind and generous deeds; diligently improved in an untiring search for knowledge; elevated and sanctified by all that is sacred in our holy religion.

> "Now, doubtless, unto him is given
> A life that bears immortal fruit
> In such great offices as suit
> The full-grown energies of Heaven."

Interesting as are our researches in Natural History, I rejoice that in the midst of these investigations we reverently pause to contemplate such a character. One after another has been called away, till the frequency becomes startling. Dr. Augustus A. Gould, whose voice we can almost hear, and the pleasant smile on whose countenance seems still to irradiate the room—Dr. Bryant, whose splendid munificence will ever be gratefully remembered. Is it really possible that those long-tried and honored friends, so lately with us in the full vigor of manly activity, will be seen by us at our meetings no more? I have thought, at times, in the grand galleries and temples abroad, dedicated to the illustrious dead, as in the Bavarian Hall of Fame at Munich (Die baierische Ruhmeshalle), that it were well if we also had such Temples of Commemoration. But have we not even here that which is most essential? This building devoted to Natural History—how does it become in itself such a temple, entwined as it is with the endeared memories of beloved associates who have gone! This Library in which we stand,—how closely is it now associated with the first President of the Society (Benjamin D. Greene)! The books he loved, and so faithfully studied, generously left to this Institution, have become his most fitting monument;—they are more than a memento, they are a living bond of perpetual union. The collections in Conchology, how do they speak to us of that noble woman (Miss Sarah P. Pratt) lately called hence, who has bequeathed to this Society her magnificent collection, the accumulated labors of a life enthusiastically devoted to that study;—while the superb and almost unequalled department of Ornithology brings ever before us in most grateful and affectionate remembrance our generous benefactor, Dr. Bryant. So, also, may these volumes of precious Records, embodying the history and progress of the Society, keep freshly in our thought our departed friend, Thomas Bulfinch. Thus this very building, while it stands a treasure-house of the manifold wonders of nature, becomes also consecrated with hallowed and inspiring memories, so that here those who have departed linger yet with us in pleasant companionship.

Mr. B. P. Mann read the following extract from a letter written by Mr. W. Hoxie, of Bridgewater, Mass.: —

I made an interesting observation on blue jays about the 16th of May. I found a nest, and was going towards the tree it was in, when one of the old birds skulked up to it and broke an egg and then flew screaming away. I climbed up into the tree, and when I was more than half way to the nest the same bird came back and broke another. When I reached the nest, there was one whole egg, and the remains of two others in it. The blue jay was a female, and I doubt whether the nest and eggs belonged to her.

Section I, Article 1, of the By-Laws was altered so as to read: —

Any person of respectable character and attainments, residing in the City of Boston, or its immediate neighborhood, shall be eligible as a Resident Member of this Society. Elections shall be held at the first meeting in the months of January, April, July and October. Nominations must be made in writing, by three members, at least one month previous to the time of elections; such nominations shall be made to a Committee consisting of the President, Recording Secretary and Treasurer, who shall report upon the same at the meeting previous to that upon which elections are to be held. Every person elected shall, within six months from the date of his election, pay into the Treasury an initiation fee of five dollars, and subscribe an obligation, promising to conform to the Constitution and By-Laws of the Society; and until these conditions are fulfilled, he shall possess none of the rights of membership, nor shall his name be borne upon the roll of members.

As some persons were nominated for membership before the change in the By-Laws had taken effect, an election was held under suspension of the rules, and the following persons were chosen Resident Members:—

Messrs. Jeremiah L. Newton and Joshua P. Preston, of Boston, and Mr. Samuel Lockwood, of Roxbury.

July 3, 1867.

The President in the chair. Sixteen members present.

Dr. Green made a communication on Binocular Vision.

Mr. W. Wickersham offered some remarks upon the travelling of rocks: after speaking of the transportation of rocks by glaciers, icebergs, floods, etc., he said he had observed that rocks travelled on the dry land without any such assistance as they receive from glaciers, etc., but by the action of frost, freezing and thawing; a rock becoming separated from a ledge, often falls some distance and then rolls. If it lies on a slope, however gentle, afterwards, the formation of ice under it moves it slightly forward, and on the return of warm weather the rock settles down a little in advance of its former position, and so on. He referred to a locality near Yokentown in York Co., Penn., at a spur of the Blue Ridge, where the rocks had moved in this manner from ledges on either side of a valley to its centre, and accumulated there in large numbers.

The President exhibited an Esquimaux "fire-stick." It seemed to him that the chief interest in speculating upon this was, that in so many different parts of the world, essentially the same process was in use for obtaining fire, in South Africa, the Pacific Islands, St. Domingo and the Arctics.

Dr. Pickering said that the method of rubbing in a groove was still in use in Tahiti, and he had seen fire obtained in that way in about three minutes.

September 18, 1867.

The President in the chair. Thirty-five members present.

Mr. H. Mann exhibited some capsules of *Cyclanthera explodens* or *elastica*, a Cucurbitaceous vine.

He showed that they were monocarpellary fruits on exactly the plan of one of the carpels of the cucumber, the placenta being inflexed to the dorsal side of the carpel, and the edges there thickened and dilated, and bearing the seeds turned towards the ventral side; only the thickened edges of the carpellary leaf acquiring a firm consistency. This part of the placenta is firmly connected with the apex of the ventral and convex side of the capsule, which, in dehiscing, becomes violently torn away from the dorsal side, carrying with it the placenta, and by the suddenness of the motion, flinging the seeds to a distance of twenty or thirty feet. Mr. Mann said that he had found a weight of five ounces insufficient to straighten the backwardly incurved ventral valve after dehiscence; more weight could not remain attached. In answer to a question of the President, Mr. Mann said that the elastic power lay wholly in the thin outer layer of cells, which were five or six times longer than their transverse diameter, and thick walled.

Mr. W. H. Niles offered some remarks upon the principle of cephalization as applied to the classification of Echinoderms.

The term cephalization is applied to the relations of the head, or anterior portion of the body, to the posterior portion, as a principle of animal structure, exhibiting the relative rank of different groups of animals. The more prominent and the more perfectly organized the head, the higher the grade of cephalization and the higher the rank of the animal. Cephalization thus becomes the principle of head or cephalic-domination, in the different forms of animal life. This principle has been ably presented by Prof. J. D. Dana, as it is embodied in the higher groups of animals and in man. The remarks of Mr. Niles were to show that the same principle is likewise embodied in a class of animals of lower rank, viz., the class of Echinoderms, which are without true heads. His remarks were especially directed to the demonstration that this principle is exhibited in the fossilized remains of the lowest beings of the class, which existed in the early geological epochs, and that, in a natural classification, they must be arranged according to this principle.

Mr. Edward S. Morse also spoke of the success he had met with in applying the principles of cephalization to the classification of the Mollusca. He drew diagrams of the six leading groups of the Mollusca in their normal position, head downward. He observed that in the cuttle-fish we have cephalization most prominent. The head is always protruded from the sac-like body, the foot is divided into numerous arms, and the jaws are perfect. In the Gasteropods, or snails, the head retracts within the sac, and the foot is a broad disk, by which they slowly crawl about. In the bivalves, the mouth is always enclosed by the mantle, and is devoid of jaws or hard parts, and the food is received from the posterior end of the body, through the currents of water passing in at the posterior part of the body. In the Ascidians, the anterior portion of the sac is closed, and the animal is fixed by that end to the rock; the mouth now turns toward the posterior portion of the sac. In the Brachiopods, we have the same conditions, namely: the anterior end of the sac closed and fixed, the mouth still nearer the posterior end, and in the lowest group of all, the Polyzoa, the mouth is at the extreme posterior portion of the body. Thus a line drawn through the mouth of these various diagrams shows the progress of that part toward the anterior end of the body. The position assigned to the classes by these principles is also in harmony with other principles of classification.

Dr. J. Wyman stated that he had recently witnessed the destruction of male spiders by the female of the same species (in this case an *Epeira*), after the union of the sexes. This habit was long since described by Lyonet, (Mém. du Mus. d'Hist. Nat., T. XVIII.) In the instance observed by Dr. Wyman, two dead males, wound with thread, were found beneath the web, and a third in the web on which the female was still feeding. On the following day a fourth male was found in the clutches of the same female, who was still in the act of sucking the fluids of her victim. Since the above was communicated, a fifth dead male was found in the same web.

Dr. Wyman also gave an account of a visit recently made to an Indian "shell heap" on one of the islands on the north side of Frenchman's Bay, near Mt. Desert, Maine.

The shells forming this deposit were chiefly those of the common clam (*M. arenaria*), with which were mingled those of *Buccinum undatum*, *Natica heros*, *Tritonium decemcostatum*, and a species of large *Mytilus*. They were deposited in two distinct strata, which had been partially carried away by the action of the sea. After the lowermost layer had been completed, the place appears to have been for a time abandoned, when it became covered to the depth of six or eight inches with a vegetable mould containing small pebbles. The shells of this lower layer were much decomposed, and had the appearance of much greater age than those of the upper. The second stratum consisted of shells well preserved, and was in turn covered with vegetable mould, and also supported a growth of forest trees. The entire thickness of the two strata was a little less than four feet. Mingled with the shells were fragments of charcoal and pieces of worked flint, including two arrow-heads. Besides the above, various implements of bone were found, consisting of slender pointed pieces, which might have served as perforating instruments, and a variety of small spindle-shaped pieces about two inches in length. One of the prongs of a large antler was found, having one of the ends rudely cut to an edge, and also a metatarsal bone of an elk, and another of a deer, which had been split lengthwise with some rude implement, probably of stone. A groove had been cut on the two sides nearly to the medullary cavity, and then the fore and hind portions of the bone had been broken apart. The groove was crooked, and the bottom and sides were roughly striated. Implements of bone have rarely been met with in this section of the United States.

More or less broken bones of the following animals were discovered, viz., elk, deer, beaver, woodchuck, seal, several species of birds, mostly aquatic, and fish. A single piece of pottery was obtained; this was made of clay mixed with finely pounded shells, and was slightly ornamented. The inner surface was covered with what appeared to be burned food.

In exploring the shell heaps above described, Dr. Wyman was aided by Dr. Calvin Ellis, Messrs. John L. Hayes, William A. Hayes, and R. E. Fitz, to whom he is indebted for several valuable specimens found by them. The specimens collected are deposited in the Peabody Museum at Cambridge.

Mr. Morse described a recent examination of shell heaps on Goose Island, in Casco Bay, Me., where he found a similar disposition of material as described by Prof. Wyman.

He also described a peculiar bead made out of the hinge tooth of the Quahog, discovered in these heaps by Mr. Chas. B. Fuller of Portland.

Section of Entomology. September 25, 1867.

Mr. Edward Burgess in the chair. Five members present.

The following papers were read: —

THE ODONAT–FAUNA OF THE ISLAND OF CUBA. BY DR. H. HAGEN, KÖNIGSBERG, PRUSSIA.

The following observations and critical remarks upon the Dragon-flies of Cuba and its vicinity, were included in a letter to me from Dr. Hagen, with permission to translate and publish the same; which I accordingly embrace this opportunity to do. P. R. UHLER, Baltimore.

The numerous and comprehensive invoices of Odonata from Prof. Poey and Dr. Gundlach (descriptions of their colors during life from the last named gentleman), and observations respecting the time of their occurrence, and other remarks, place me at present in a position to contribute decidedly more precise information respecting the Odonata of Cuba than was the case in my work upon the Neuroptera of North America.

I give here a review of the already known species of Cuba and the Isle of Pines, and, at the same time, a recognition of the species described by Mr. Samuel H. Scudder in the Proc. Boston Soc. Nat. Hist., Vol. x., p. 187. The descriptions of Mr. Scudder are so satisfactory that I believe I have been able correctly to recognize all of his species.

AGRIONINA.

Lestes forficula Ramb. July to October, about ponds, at Cardenas.

Lestes tenuata Ramb. July and August, about the banks of ponds, at Bayamo.

Lestes spumaria Hagen. July, in woods, at Cardenas.

" " var. minor? Cardenas.

Lestes scalaris Hagen. July and August, flying over ponds.

Hypolestes trinitatis Hagen. Near the town of Trinidad, also at Bayamo, in July and August.

Protoneura capillaris Rambur. In woods near Bayamo; also, about rivers and brooks of the western half of the Island, in June, September and October.

Microneura caligata Hagen. About brooks near Trinidad, in September and October.

Neoneura carnatica Hagen. On streams about Cardenas, April.

Neoneura palustris Hagen. This species is identical with *Agrion Maria* Scudd. *N. palustris* is perhaps only a variety otherwise colored of *N. carnatica* Hagen.

Agrion civile Hagen. A male was received in my last invoice.

" **Doubledayi** Selys. I have seen no specimen of this species from Cuba, but I place it here upon the authority of DeSelys Longchamps; vide La Sagra, Ins. Cuba, p. 469.

Agrion cœcum Hagen. At Havana, about rivers, and in the western part of the island, Trinidad. The numerous specimens received exhibit a local variety, *A. cardenium* Hagen. This is certainly the same as *A. cœcum* Scudd.

Agrion cultellatum Hagen. July and August, in marshes.

" **truncatum** Hagen. About ponds, in July and August.

Ischnura iners Hagen. At Cardenas, about ponds, July to November; very common. This species is very probably the same as *A. tuberculatum* Selys, l. c. p. 467; yet I am not able to say so from actual examination of DeSelys's type. To this species must be reunited *A. credulum* Hagen, and *A. defixum* Hagen.

Ischnura capreolus Hagen. About ponds, in July and August.

Anomalagrion hastatum Say. About ponds and in woods, in March, July and August; and at Cardenas and Bayamo, about ponds, in September and October. *Trichocnemis minuta* Selys, l. c. p. 464, is a fully colored female of this species.

Pyrrhosoma vulneratum Hagen. At Cardenas, in woods, July. In the description of the male, (Neur. of N. Amer. p. 86,) another species, *A. præsectum* Hagen, from Porto Rico, is erroneously united with this. Probably *A. discolor* Selys, l. c. p. 466, (nec Burm.) is identical with *A. vulneratum*.

Leptobasis adunca Hagen. About ponds, July and August.
" **vacillans** Hagen. About ponds, September, near Bayamo. The species referred to by DeSelys Longchamps, l. c. p. 465, *Agrion macrogaster*, *A. Dominicanum*, *A. Ramburii*, from the adjacent islands, have not yet been known to belong to Cuba; the same is also true of *Mecistogaster Lucretia*, and *Hetærina cruentata*. These five species belong to St. Domingo, Jamaica, Martinique.

ÆSCHNINA.

Anax Junius Drury. Not scarce.
" **Amazili** Burm. Scarce.

Gynacantha trifida Ramb. At Cardenas, in woods, in August and September; also flying during the evening. Along the coasts it assembles in large flocks, flying from the north towards the south, in December.

Gynacantha septima Selys. This species, also, flies in flocks.
" **oreagris** Hagen. At Cardenas, in woods, in August and September.

Gynacantha *nov. spec.* I have not yet seen this new species, detected by Dr. Gundlach; the wings are yellow at base.

GOMPHINA.

Progomphus integer Hagen.

Gomphoides producta Selys. At Cardenas, about ponds, in October and November. I am not yet sure that two species are here mixed together, nor whether the so called variety, *G. Caraiba* Selys, l. c. p. 456, is to be separated as a distinct species.

CORDULINA.

Tetragoneuria balteata Hagen. One male known to me.

LIBELLULINA.

Pantala flavescens Fabr. At Cardenas, on the coast, in August and until October.

Pantala hymenæa Hagen. At Cardenas, in October.
" **citrina** Hagen. At Cardenas, in woods, during July.

Tramea carolina Linn. I have not seen a specimen of this species from Cuba, and I place it here only upon the authority of De Selys, l. c. p. 440.

Tramea onusta Hagen. A single male seen by me.

" **abdominalis** Rambur. At Cardenas, in bushy places. Under the name of *T. insularis*, Mr. Scudder describes a female taken in the middle of May. The males captured by him at the same time are manifestly *T. insularis*.

Tramea insularis Hagen. At Cardenas, in bushy places, in October.

Tramea marcella Selys. At Cardenas, in bushy places, in July.

" **simplex** Rambur. At Cardenas, in bushy places, in November.

Tramea australis Hagen. At Cardenas, in woods, in July.

Celithemis Eponina Fabr. A single male examined.

Libellula umbrata Linn. This is a very common species. At Cardenas, about ponds, in October and November. In April and July it affects woods, and also the seacoast. The females with a dark band upon the wings, as in the males, are very rare. I have seen three specimens.

Libellula angustipennis Rambur; also of Mr. Scudder. Cardenas, in July, in bushy places.

Libellula herbida Hagen. At Cardenas, in October and November.

Libellula auripennis Burm.; also of Mr. Scudder. At Cardenas and Cienfuegos, in April and July. It is not rare.

Orthemis discolor Burm. At Cardenas, in woods and about ponds, in July and October. It is quite common.

Lepthemis vesiculosa Fabr. At Cardenas, in April.

" **Attala** Selys; *verbenata* Hagen. At Cardenas, in September.

Dythemis rufinervis Burm.; *Libellula vinosa* Scudder, l. c. p. 192. Found at Cardenas, in woods, in July, and from September to November.

Dythemis frontalis Burm., Scudder. At Cardenas, on the banks of rivers, in May and June; in the western part of the Island at Rangel.

Dythemis pleurosticta Burm., Scudder. At Cardenas in fields and about ponds, in July, October, November.

Dythemis didyma Selys. At Cardenas, about ponds, in October and November.

Dythemis dicrota Hagen, = *Mesothemis Poeyi* Scudder, l. c. p. 494.

Dythemis æqualis Hagen. At Cardenas, in woods and about ponds, in July and October.

Dythemis næva Hagen. At Cardenas, in August and September.

Dythemis debilis Hagen. At Cardenas, about ponds, from August to October.

Dythemis exhausta Hagen. At Cardenas, on the seacoast, in August and September.

Erythemis furcata Hagen. Rare.

" **longipes** Hagen, var. *specularis*,=*Macromia cubensis* Scudder, l. c. p. 190, at Cardenas, in April, July and October.

Mesothemis simplicicollis Say, = *M. Gundlachii* Scudder, l. c. p. 194; at Cardenas, in woods, in May and June.

Mesothemis Mithra Selys. At Cardenas, in woods, July.

Diplax ochracea Burm., Scudder. At Cardenas, in fields and woods, in July, August, October and November.

Diplax abjecta Rambur, Scudder. At Cardenas, in October.

" **Justiniana** Selys.

" **ambusta** Hagen. *Justiniana* Hagen, of the Synops. N. Amer. Neur.; Scudder.

Diplax *nov. spec.* Hagen.

Perithemis Metella Selys; *P. Domitia* Hagen, Synops.: Scudder. At Cardenas, in September and October.

Besides the foregoing, there are descriptions of six species in my possession which must be compared with already known species before deciding upon their identity. With respect to the species noticed by Mr. Scudder, from the Isle of Pines, we find:—

Agrion Maria = Neoneura palustris.
Agrion cœcum = A. cœcum, var. Cardenium.
Æschna virens.
Macromia cubensis = Erythemis longipes, var. specularis.
Tramea insularis = Tramea abdominalis.
Libellula auripennis.
Libellula angustipennis.
Libellula vinosa = Dythemis rufinervis.
Dythemis frontalis.
Dythemis pleurosticta.
Mesothemis Poeyi = Dythemis dicrota.

Mesothemis Gundlachii = Mesothemis simplicicollis.
Diplax ochracea.
Diplax justiniana = Diplax ambusta (Justiniana, Synops.).
Diplax abjecta.
Perithemis Domitia = Perithemis Metella (Domitia Synops.).

Some of the species noticed by Mr. Scudder, I also possess from the same island.

Mr. Scudder has further, in the same volume of Proceedings, p. 211, given "Notes on some *Odonata* from the White Mountains of New Hampshire." I have carefully compared the detailed descriptions there given with specimens in my own collection, and I am able to report as follows:

Cordulegaster lateralis, I possess from Massachusetts, sent to me by Mr. Uhler (No. 182), which undoubtedly belongs to this species, and which I have identified as *C. Sayi* Selys. Nevertheless, it differs somewhat from the description, in the color of the body, yet that description is based upon notes of DeSelys Longchamps made several years ago, and it is certainly not sufficiently complete. At all events an examination of the type in the British Museum will be the only true means to enable a decision as to its identity.

Æschna constricta Say.
" **eremita** Scudd. I possess this species from Saskatchewan and Fort Resolution, collected by Robert Kennicott.
Æschna propinqua Scudd. I have this species, also, from Fort Resolution, collected by Robert Kennicott.

Cordulia eremita Scudd. I take this to be *C. albicincta*, Burm., but yet the identification is not positive.
Cordulia forcipata Scudd. This is the European *C. arctica*, or it is very closely related thereto. I have it from Fort Resolution, collected by Robert Kennicott.
Cordulia Shurtleffii Scudd. is the *C. bifurcata* Selys.
" **Walshii** Scudd. This is new to me.
" **elongata** Scudd. This is also new to me.

Diplax rubicundula. Mr. Scudder's remarks upon this species are pertinent, yet I hold it to be distinct from *D. assimilata* Uhler, and I will hereafter report upon it at full length. The specimens from Mr. Walsh are the most difficult to decide on, because they occupy almost an intermediate position between the two species.

SOME REMARKS UPON THE ODONATA OF HAYTI. BY P. R. UHLER.

The foregoing paper of Dr. Hagen affords me a welcome opportunity to remark upon some of the Dragon flies which I observed and collected in Hayti, while there engaged in collecting specimens of Natural History for Prof. Agassiz.

AGRIONINA.

No species of *Lestes*, *Calopteryx* or *Hetaerina* were seen by me in Hayti, although they might have been found there about the beginning or end of the second rainy period, in September or October. The Grand-Anse River is full of small rapids, and the banks are covered in places with bushes and vines projecting over the surface, furnishing those delightfully shady spots which such insects are wont to frequent.

Anomalagrion hastatum Hagen, was met with behind a strip of land projecting into the Grand-Anse River, where the water was still and crowded with pond lilies.

Agrion Dominicanum Selys, was first captured while it was hovering over a brook issuing from a spring, high up the side of the Côté de fer, about three miles from Jérémie. I next found several specimens flying about the edge of a marsh near the road leading along the Grand-Anse River. The times of its appearance were in April and May.

Several other species of *Agrion* were captured about the surface of the river, but I have not yet been able to ascertain their names. The Grand-Anse is full of shallow places having a muddy bottom, and there the pond lilies grow in great abundance; on the leaves of these plants the Agrions delight to settle, and there they can be taken in the greatest numbers.

GOMPHINA.

A single specimen of *Gomphoides* (the species is not known to me) was procured at a spring high up the side of the mountain beyond Jérémie. It was flying backward and forward over the stream issuing from the spring, and the colors were dark brown and light green. No species of *Gomphus* was met with upon the Grand-Anse River, although there were many places such as they are accustomed to frequent, and notwithstanding my thorough search for them.

ÆSCHNINA.

Æschna virens Ramb. I was unable to capture the only specimen that I saw, which was flying with great rapidity near the road along the River Grand-Anse. It once alighted on the limb of a tree within full sight, but beyond the reach of my net, and it appeared to me to be this species.

LIBELLULINA.

No species of *Epitheca* or *Cordulia* were seen by me, although I maintained a sharp lookout for them.

Tramea insularis Hagen. The species procured by me agrees perfectly well with the description of Dr. Hagen, while it disagrees with that of *T. abdominalis* Hagen, in the length of the superior anal appendages. It also corresponds with specimens collected by Mr. Scudder in the Isle of Pines, and which were presented to me through his generosity. Both sexes were taken together in one place. This species seemed to be rather common, hovering over the dusty road and flying usually at a height of ten to fifteen feet above the ground. Its flight is rapid, but not so dashing as that of *T. lacerata* Hagen. They are difficult to capture, because shy and wary. Two males were obtained, which agreed perfectly with the others, except in the color of the front and vertex, which were not blue, but reddish. Unfortunately these two specimens shared the fate of several others in being destroyed by the minute ants which there overrun everything. At no time did I see this species affecting the bushes. They were ever on the wing, flying backward and forward through a limited space over the roadside.

It was observed in March, April and May. No specimens were seen in the mountains, but in the valley close by the Grand-Anse River they appeared to be most numerous.

A female in my collection, from St. Thomas, occupies an intermediate position between *T. abdominalis* and *T. insularis*. It agrees with the former in having no blue upon the front and vertex, the anal superior appendages are a little more than the length of the two last segments, and the spots of the wings and remaining characters are those of *T. insularis*. May not the two so-characterized species be nothing more than local forms of one?

In *Tramea lacerata* Hagen, the front and vertex are usually steel-blue, but I have seen specimens agreeing in other respects, yet differing in having these parts reddish, or with only a vestige of blue upon the front. When recently excluded, the blue of this species is very faintly discernible. I cannot help supposing the species of Mr. Scudder to be the *T. insularis* Hagen. It agrees so perfectly with the description of Dr. Hagen, while it equally disagrees with that of his *T. abdominalis*. There is but little uniformity in the number of the ante and post-cubital cross-nervules. The number frequently varies in the opposite wing, and in different specimens the ante-cubitals range from 9 to 13 in each anterior wing.

Libellula umbrata Linn. This species is very abundant in swampy places, settling upon the bushes, and is easy to capture before the sun is high. I observed no females with the band across the wings as in the males, but they varied very much in size. When old and weather-beaten the abdomen becomes dirty olive colored and the wings assume a dirty yellow, somewhat as in our *Diplax rubicundula* Say. I observed it near the mouth and in the vicinity of the banks of the Grand-Anse River, in many places beyond Jérémie; in April and May.

Libellula angustipennis Rambur. I obtained a few specimens on the edge of a reedy swamp. It was by no means common. The teneral male has a red abdomen; in the fully adult this part is blue. The species flies low, and not rapidly, preferring the open spaces between the reeds and often settling upon projecting leaves. I saw it first in May.

Orthemis discolor Hagen. This was by far the commonest species observed by me in Hayti. It affected the vicinity of streams and puddles, as well upon the tops and sides of the less elevated mountains as in the valleys. Some specimens were obtained at an elevation of more than one thousand feet above the level of the sea. Its mode of flight is quick, but not dashing, recalling that of our *Libellula pulchella*, usually extending over a space of two or three rods, and now and then alighting upon a projecting branch or stick. During life, the whole body appears bright red while flying in the bright sunshine, but it turns to a dull reddish-blue, or brown, after death. The fully adult males are powdered with blue. The females are of a lighter and brighter red, and they are very much less numerous than the males, at least during April and May.

Lepthemis vesiculosa Hagen. During life this species is of a bright apple-green color, the spots upon the abdomen appearing deep black. It is rather a tame species, settling upon bushes in the vicinity of the sea. Its flight, though rapid, is not continued far, and it seems to delight in dashing up and down after the mosquitoes which abound in the air during the evening twilight. It appeared about the middle of April and was to be seen when I was ready to leave, in May.

Dythemis rufinervis Hagen. Two individuals were observed and captured near a brook running from the side of the mountain, at a considerable elevation above the sea. They appeared in May.

Dythemis frontalis Burm. was captured while flying back and forth over a stream issuing from the side of the mountain at an elevation of apparently more than one thousand feet above the level of the sea. Three males were captured, which were almost entirely lead-blue in color. Time of appearance was in May. It was by no means abundant.

Dythemis pleurosticta Hagen. This species was quite common, flying in company with the preceding on the side of the mountain. I afterwards saw some specimens along the side of the road, in the valley next the mountain. April and May.

Mesothemis mithra Hagen. A single male of this species was captured by me near the Grand-Anse River, in May. I saw only two other specimens of this species, which were flying with great rapidity over the surface of the river, but my greatest exertions did not enable me to capture them. Their flight is very rapid and steady.

My short stay in the Island of Hayti did not allow me to make distant excursions to procure specimens of the insects peculiar to the interior of the country. No sooner do the rains begin than all nature seems to spring into life, and could I have remained there until the wet season was over, I am sure that many more species must have rewarded my pains.

ADDITIONAL REMARKS UPON THE ODONATA OF THE ISLE OF PINES AND OF THE WHITE MOUNTAINS OF NEW HAMPSHIRE.

BY SAMUEL H. SCUDDER.

Since reading the statements of Dr. Hagen in the preceding paper, I have been induced to reëxamine the specimens which I used in preparing my papers on the Odonata of the Isle of Pines and of the White Mountains of New Hampshire;* the following remarks give the result of this examination.

It is evident from the nature of Dr. Hagen's invaluable Synopsis of the Neuroptera of North America, that the work was not intended for a monograph, and that the short descriptions of genera, and other larger groups which it contains, were only added as convenient diagnoses. When my papers were prepared, this work, together with Rambur's Neuroptera and De Selys's descriptions of Cuban Odonata, were almost the only authorities at my command. Working under such disadvantages, I could hardly help falling into those errors of determination which Dr. Hagen has pointed out.

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* These Proceedings. Vol. x., pp. 187, 211.

Libellula vinosa=Dythemis rufinervis.

My specimens disagree decidedly with Dr. Hagen's description; the dorsum of the thorax of both male and female has an obsolete yellow line; the sides are not yellowish, four-striped with ochraceous yellow; there is no dorsal black stripe on the eighth and ninth abdominal segments; the appendages are not rufous, but always have the apical half blackish. No mention is made by Dr. Hagen of the infuscation of the wings at tips; my specimens are all smaller than Dr. Hagen's measurements.

Macromia cubensis=Erythemis longipes, *var. specularis.*

Besides having tuberculated eyes, in which they agree with the diagnosis of *Cordulina*, my specimens accord with the meagre generic characters given by Dr. Hagen to *Macromia.* I therefore placed them at once in that group. Dr. Hagen states that the color of the abdomen is rufo-fuscous, like that of the mouth and thorax, but, in my specimens, it is not so.

Tramea insularis=T. abdominalis.

It is impossible to refer the males of my collection to *T. abdominalis.* In the markings of the front and vertex; the color of the feet; the length of the fascia at the top of the dorsum of the abdomen; the length of the superior anal appendages; the length of the hamule and the color of the pterostigma—the only trenchant distinctive characters mentioned by Dr. Hagen—the specimens agree completely with *T. insularis*, and disagree as entirely with *T. abdominalis.* The female, however, does not accord with the descriptions of either; on the one hand, the markings of the head and vertex differ from those of *T. insularis*, in the manner described in my previous paper, and the terminal segment of the abdomen has a black fascia, continuous with that of the preceding segment: on the other hand, the fulvous pterostigma and the rufous base of the black femora, do not agree with the characters Dr. Hagen assigns to *T. abdominalis.* When such slight distinctive characters are given by which to separate these two species, and especially when these characters are equally balanced in a single specimen, it is difficult to decide where to place it.

Mesothemis Gundlachii=M. simplicicollis.

My specimen differs from Dr. Hagen's description of *M. simplicicollis* in having the sides of the thorax nearly immaculate; the slight markings which occur are of a pale brown, and, by no means, black. Also, and more especially, the sides of the abdomen are not in the least "broader before the apex," but strictly parallel; this may be due to distortion in drying. There are more markings on the dorsum of the abdomen than are mentioned in the description of *M. simplicicollis*.

Mesothemis Poeyi=Dythemis dicrota.

My specimens agree better with Dr. Hagen's generic description of *Mesothemis* than with that of *Dythemis*. No mention of the humeral stripe is made in his description of the species.

Cordulegaster lateralis=C. Sayi?

My specimens disagree with De Selys's description of *C. Sayi*[*] in the markings of the abdomen, which is never annulated, but has spots on the sides, approaching each other on the back; in the form of the anal appendages, which, among other distinctions, have no basal inferior tooth, but a median one; in the color of the pterostigma, and in the number of post cubitals.

Cordulia eremita=C. albicincta?

C. eremita is a larger species than *C. albicincta:* the inferior appendage is scarcely more than half as long as the superior. In my description I have not mentioned a serrate tubercle, situated near the base of the outer edge of the superior appendage; it is similar to the median tubercle, but bent downwards, not at all outwards.

Cordulia forcipata=C. arctica?

If the illustration given by De Selys and Hagen[†] is correct, *C. forcipata* cannot be referred to *C. arctica*, on account of the form of the superior anal appendages of the male.

Mr. J. C. Merrill, Jr., announced the capture of *Pieris rapæ*, hitherto unknown in New England, at Waterbury, Burlington and Stowe, Vt.; the specimens were very abundant at the former locality, exceeding in number the individuals of *P. oleracea*, with which they were found in company. He had also taken a single specimen at the White Mountains in 1866; only one wing was preserved. The species has been recorded in this country from Quebec only.

Mr. S. H. Scudder stated that Mr. Sprague had recently shown him specimens captured this summer in Lewiston, Maine.

[*] Monographie des Gomphines, p. 591.

[†] Revue des Odonates. Pl. II., fig. 1.

October 2, 1867.

The President in the chair. Thirty-seven members present.

The President exhibited a series of flint implements from the Island of Rügen, and from Norway and Sweden, consisting of arrow and spear heads, square cut chisels, etc. One was a hatchet, with a circular hole for the insertion of the handle, the interior of which was smooth, and the diameter uniform. Mr. Rae, the Danish Consul in New York, had shown how these holes might be drilled, by boring half through a paving stone with a rotating broomstick and sand. A few implements representing saws and knives, and one, undoubtedly used as a dagger, but resembling a large spear point, were among the articles exhibited; most of them were unlike any found in this country.

Dr. Wyman further gave an account of a recent visit by a party of members of the Society to shell heaps, upon Goose Island, in Casco Bay. The objects exhumed were nearly similar to those found at Mt. Desert, and described by Dr. Wyman at a previous meeting. Among the most interesting objects were bones, apparently of the Great Auk, a bird now extinct.

Mr. Edward S. Morse called attention to the evidences of great antiquity in the shell heaps at Goose Island.

The deposits consisted of large beds of broken clam shells with other species intermixed. Over five hundred square feet of surface had been examined. and the entire absence of any metal, and the singular scarcity of stone implements were noteworthy. The deposits showed an outcrop on the bank of from two or three to fourteen or fifteen inches. As these heaps thickened very gradually toward the centre, and covered areas of from ten to fifteen feet in diameter, this outcrop showed evidences of extensive erosion of the bank since the heaps were formed. Coupled with this fact, he noticed one place where the erosion of the bank had exposed the surface of a rock smoothed and scratched by glaciers, and a sufficient time had elapsed to erase nearly all these marks from the hard rock. He also remarked that the shell heaps appeared to rest on the primitive soil. The turf covered these heaps to the depth of six or seven inches, while there were no traces of soil below. The land shells, such as *Helix Sayii*, *unidentata*, *multidentata*, and others, remains of which were found in the lower portions of the heaps, can only exist in hard wood growths. The portion of the island where these heaps occur is at present covered with large spruce growth. The Quahog, found plentifully in the heaps, is extremely rare in Maine. Thus we have a change of vegetation, a change of certain species of animals, an evidence of extensive erosion of the banks, an absence of articles that one would be likely to find in deposits of recent formation, all indicating extreme age. Of course, these evidences do not indicate the age of the shell heaps, further than to show that hundreds, perhaps thousands of years, may have elapsed since they were first commenced. The Danish archæologists regarded similar heaps in Denmark as older than the stone age; in fact, as among the earliest evidences of the presence of man.

A short discussion ensued upon the probability that the shell heaps rested upon the primitive soil. Mr. Scudder wished to know what had become of the vegetable mould which supported the hard wood growth, beneath which the land shells found at the bottom of the shell heap lived. Dr. Pickering believed that vegetable mould would disappear after the lapse of ages by the action of the elements, and Dr. Jackson spoke of the chemical means by which this would be brought about.

Section of Microscopy. October 9, 1867.

The Curator in the chair. Thirteen members present.

Mr. C. Stodder read a note on *Navicula Carassius.* Ehrenberg's description is as follows:—"Ventricose, inflated, broadly lanceolate, with the ends suddenly contracted into short, conical beaks; striæ wanting, or indistinct." As seen with Tolles' one-tenth immersion lens, Mr. Stodder adds to the above description,—striæ diagonal or quincunx, like many of the *Pleurosigmas*, very faint and fine, nearly ninety thousand to the inch; length of frustule about three one-thousandths of an inch; locality, Bridgeton, Me. Recent specimens were communicated by Dr. Thos. F. Perly.

He remarked that the objectives used by Ehrenberg, when he published his great work on *Infusoria*, were undoubtedly very much inferior to the instruments now in the hands of our microscopists. Mr. Stodder exhibited, in connection with this, the one-tenth objective with immersion front, which he used in resolving the markings above described.

Mr. R. C. Greenleaf placed on the table an immersion lens from Hartnack of Paris, one-fifteenth focus; also one from Tolles, of the Boston Optical Works, one-fifth focal distance.

These objectives Mr. Greenleaf said he had used with great satisfaction, being able with them to resolve some of the most difficult test objects, such as the Cuban *Amphipleura*, *Amici* test, or small specimens of *Navicula rhomboides*, with more ease and certainty than he had ever resolved them with any dry lens. The one-fifth lens, made by Tolles, works with great distinctness, bearing the higher eye pieces admirably.

The Cuban *Amphipleura* was shown by Mr. Greenleaf to illustrate the working power of these various objectives.

Mr. C. Stodder exhibited a student's microscope stand from the Boston Optical Works. This instrument will be provided with one eye piece and two objectives, an inch and quarter inch. The tube has coarse and fine adjustment. An independent stand is made for the mirror, so that it can be used for illuminating opaque objects. The whole instrument will be of the best workmanship, and produced at the lowest possible cost.

October 16, 1867.

The President in the chair. Forty-four members present.

The President, referring to the record of the previous meeting, stated that he had made a further examination of the bones found at Goose Island, and had had an opportunity of comparing them with Owen's plates of the Great Auk. The humerus of the bird proved to be identical with the figures by Owen, leaving no doubt of the character of the remains.

In response to an invitation by the President, Professor Agassiz offered some remarks upon the antiquity of man.

He said that fifty years ago both the learned and unlearned believed they possessed a trustworthy chronology of human history. Historians struck the first blow at this assumption by their researches into the successive dynasties which had ruled over Egypt. Their lead was quickly followed in the different departments of science, until now we are forced to cast aside the ancient beliefs, and construct our chronology from a new and independent basis. Twelve years ago, Ferdinand Keller of Zurich, by his examination of the lake deposits of Switzerland, brought to light proofs of the existence of races of men with new characters of civilization. These discoveries astonished the world, and have since given rise to a new science, new societies, and new museums. Humanity is now connected with geological phenomena.

Formerly the presence of such large mammals as the *Elephas primigenius*, *Rhinoceros tichorinus*, *Bos primigenius* and *Ursus spelæus*, was considered the dividing line between geological and human history—now the extensive researches of such able naturalists as Lartet, Von Baer, Rütimeyer and Brandt, have proved that these quadrupeds were once contemporaneous with man. The question before us is whether we can establish a successive chronology of events since the appearance of these animals upon the earth. Brandt has attempted to show that they were living within the historical period, and has argued therefrom that the native cattle of Europe were developed from the *Bos primigenius*. The argument for their recent extinction is drawn from documents hitherto partly unknown, because written in the Sclavonic tongue; these represent the existence of *Bos primigenius* in the forests of Lithuania and Poland, up to the eleventh and thirteenth centuries. The presence of *Cervus megaceros* in the marshes of Europe up to the fourteenth century is also made probable.

There is no doubt that the fauna of the diluvial deposits and of the European caves consisted of animals, some of which, at least, had a circumpolar geographical distribution, and that the southern limits of animals now living in the polar regions were once much greater than now; remains of the reindeer have been found all through France to the Pyrenees and in Southern Germany. We find that these mammals had intimate relations with the ice period, and it becomes necessary for us to investigate the extent of the ice-fields at the time when the glacial period was at its height. Prof. Agassiz believed that the changes in extent, which our ice-fields have undergone during successive periods, would furnish us with data for our chronology. In America, the ice-fields, at the time of their greatest extension within definite limits, reached the thirty-second degree of north latitude. In Europe, they extended as far as the plains of Lombardy. Subsequent to this came a limited glacial period, in which the Southern and Middle States were freed from glaciers, but from Maine westerly, the country was still ice-bound. During a third period, the ice retreated to the northern shores of Lake Superior and the slopes of Mt. Kataadn, while in a fourth period, the one before the present, the continent was clothed with vegetation up to the hilly parts of Canada.

In answer to the question whether we had any means of connecting chronology with these facts, it might be stated that none of the cave animals, or the large mammals which have been mentioned, have been proved to exist prior to the time of the greatest extent of the ice-fields; and, as it can no longer be doubted that man lived contemporaneously with these animals, he believed that with the waning of the ice period began the era of primeval man. In the successive epochs of the ice, indicated by the retreating ice, we have a *relative* chronology; when we ask for more specific statements of age, we find ourselves at once at a loss for an answer. Some indications might be seen in the abrasions of rocks of unequal hardness, and instances were cited in illustration of this.

In the course of the discussion which followed these remarks, Prof. Agassiz said he hoped for great results from the investigations now undertaking in our own country, and believed that marks of the reindeer would yet be found in the Carolinas.

The President stated that he had recently visited Dighton Rock, in Taunton, and had examined the inscription upon it. The marks were evidently made by a picking instrument. He found that Kendall's drawing, in the Memoirs of the American Academy, was generally correct, although the upper portion of the rock now presents a different appearance, on account of the removal of fragments by excursionists.

Dr. B. G. Wilder alluded to the reports lately contained in New York papers, concerning what was alleged to be a live gorilla in Barnum's Museum.

From information given him by Dr. Herrmann Hagen (of Königsberg, Prussia), and by Mr. James H. Morse of New York, he was satisfied it must be some large dog-faced baboon (*Cynocephalus*). He urged the establishment of Zoölogical gardens, in order to counteract such attempts to deceive the people.

Mr. Morse writes: "The animal is a male, a little larger than a Newfoundland dog, nearly black in color, and has a tail about two feet in length; the snout is long, and the arms but little longer than the legs. I did not see him stand upright at all, but he went easily on all fours."

In this connection, Dr. Wilder referred to the "What is it," which was exhibited at Barnum's Museum in 1861, as "a connecting link between man and the lower animals"; but which he examined in March, 1861, and found to be only an idiotic negro-boy. It presented no resemblance to the apes beyond the smallness of the cranium, and a tendency to keep the body and limbs slightly flexed: but this last seemed to be the effect of weakness or habit, and did not appear to be connected with any anatomical peculiarity; the spread of the arms was precisely equal to the height of the body, as shown by the following measurements:

	ft.	*in.*
Length of body to heads of thigh-bones.	1	10
" " legs from " " "	2	2
Height of whole body, as though standing erect	4	0
Length of each arm from arm-pit to finger-tips	1	8
" " the two arms	3	4
Breadth of chest between arm-pits		8
Whole spread of arms	4	0
Breadth of shoulders (between tips of acromion processes) . .		11
Length of feet (about)		7

The Custodian announced that Mr. W. Ingalls had recently deposited in the Museum a large collection of paintings of fruits of Brazil, executed by himself, which were to be placed in the Botanical room. As the temporary arrangement of the geological department was now completed, both of these rooms would be opened to the public on the next visiting day.

Section of Entomology. October 23, 1867.

Mr. L. Trouvelot in the chair. Nine members present.

The following paper was read:—

NOTES ON THE STRIDULATION OF SOME NEW ENGLAND ORTHOPTERA. BY SAMUEL H. SCUDDER.

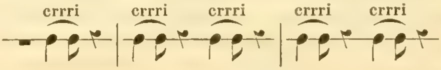
In studying the songs of *Orthoptera*, a serious obstacle will be found in the feebleness or delicacy of the sounds which many species emit. To distinguish the notes clearly, one must bring his ear to within a few feet, or even inches of the insect during its stridulation —a process which requires great caution lest the extreme shyness of the little violinist should overcome his egotistic love of song. Once disturbed, these insects wait some time before recommencing to chirp; to obviate the tedious delay, I have had recourse to artificial means, imitating the note myself with a quill edge and file; a quick response is almost sure to follow.

My plan of observing them is as follows: after walking quietly toward the sound until it ceases—this generally takes place when I am at a distance of twenty or thirty feet—I wait motionless for its renewal; then, carefully marking the direction of the note, for it is almost impossible to determine the distance, I pass cautiously around the arc of a wide circle, until I get another line nearly at right angles to the first, and thus fix approximately the position of the insect. I then walk rapidly, but with as little disturbance as possible, to within five or six feet of my goal, stoop down or fall upon my hands and knees, and produce my apparatus. I commence my mock stridulation after a short delay; at first, the sounds must be subdued and separated by considerable intervals, then loud and repeated in quick succession. Before a minute has elapsed, and, often, in a few seconds, I hear the response. After holding a short conversation in this way, I permit the insect to chirp to his neighbors, and searching for him in the grass, approach him quietly while he sings, remaining motionless in the intervals. One may thus place himself within a few inches of any species living in the grass, or upon foliage of any kind, and narrowly observe all its movements.

Our *Orthoptera* stridulate in three different ways: first, by shuffling the bases of the elytra together; second, by scraping the hind thighs upon the outer surface of the elytra, and third, by rubbing together the elytra and the thickened veins of the anterior edges of the wings. *Gryllides* and *Locustariæ* use the first method; *Acrydii*, the other two. The apparatus employed in the first case, consists of a peculiar conformation of the veins at the base of the elytra; in *Gryllides*, these veins occur in the central field, but in the *Locustariæ* in the inner field of the wing.

In each of the various groups, the pitch presents a great degree of uniformity. The *Gryllides* have the shrillest note; the *Locustariæ* succeed them; among the *Acrydii*, those species which use their legs in stridulating, rank third in order of shrillness, while those which rub their wings and wing-covers together have the lowest note of all.

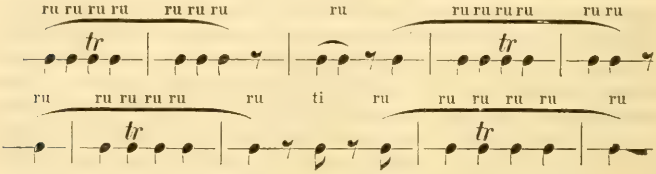
Harris is wrong in stating that our crickets do not begin to chirp before the autumn months; they are heard in this vicinity from the middle of June until November; in the White Mountains their chirping did not commence this year until the 12th of August. The note of the common species (*G. neglectus*) is *cr-rur-ri* or *crrrri;* the rapidity with which it is uttered seems to vary very much, even in a single strain by one insect. Sometimes the notes are produced as slowly as two per second, but they may be twice as rapid; the mean seems to be the usual rate. The note is sharp and shrill, and is apparently pitched at E natural, two octaves above middle C.



Note of Gryllus neglectus.

In listening one night in midsummer to the chirping of these insects, I heard two choirs, one on either side of me, separated by a garden fence. The individuals of each chirped together at the rate of about two notes per second, but, whether owing to the influence of a warmer situation, or a fuller exposure to the moonlight, one choir invariably chirped a little faster than the other, and fourteen seconds elapsed between the perfect accord of the two choirs and their complete discord; from this, fourteen seconds more to their former synchronism. These cycles occurred twice per minute, and followed each other with remarkable regularity for about an hour.

Nemobius vittatus appears quite as early as *Gryllus*, if not earlier. Its chirp, although very similar to that of *Gryllus*, can be better expressed by *ru* or *rrru*, pronounced as though it were a French word. The note is trilled forcibly, and lasts a variable length of time; sometimes for several seconds; at others, it is reduced to a short, sharp click.



Note of Nemobius vittatus.

* It is necessary for me to describe the peculiar system of musical notation which I have adopted. Each bar represents a second of time, and is occupied by the equivalent of a semibreve; consequently a quarter note (♩), or a quarter rest (𝄽), represents a quarter of a second; a sixteenth note (𝅘𝅥𝅯), or a sixteenth rest (𝄿), a sixteenth of a second, etc. For convenience' sake I have introduced a new form of rest (▬ or ▬), which indicates silence through the remainder of a measure.

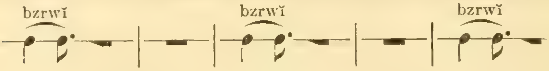
A few days ago I observed one of these insects singing to its mate. At first the song was mild and frequently broken; afterward it grew impetuous, forcible and more prolonged; then it decreased in volume and extent till it became quite soft and feeble. At this point the male began to approach the female, uttering a series of twittering chirps; the female ran away, and the male, after a short chase, returned to his old haunt, singing with the same vigor as before, but with more frequent pauses: at last, finding all persuasion unavailing, he brought his serenade to a close. The pauses of his song were almost instantly followed by a peculiar jerk of the body; it consisted of an impulsive movement backward, and then, as suddenly, forward, and was accompanied by a corresponding movement of the antennæ, together and then apart. The female was near enough to be touched by the antennæ of the male during the first movement, and usually started in a nearly similar way as soon as touched.

The elytra of the male are held at an angle of about twenty degrees from the body during stridulation, and, perhaps, at a slightly greater angle from each other. Even when most violent, the sound is produced by the friction of the inner edges of the elytra only, not by the whole surface; much smaller surfaces are brought together than is the case with the *Locustariæ*.

In September and October, the *Œcanthus niveus*, or white climbing cricket, may be found, often in large numbers, on the leaves of low trees and bushes. Its song lasts from one and a half to three seconds and consists of a sustained, equable, attenuated, creaking roll. I have only listened to the insect in captivity, when its utterance was faint, but Dr. Harris states that complaints are often made of the piercing shrillness of its cry.

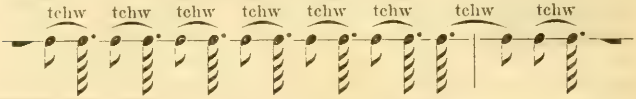
I am familiar with but few songs of the *Locustariæ;* at the White Mountains two species—*Phaneroptera curvicauda* and *Orchelimum vulgare*—appear about the last of July. The latter shrills equally by night and day; the former is more noisy by night. In *Phaneroptera* the day and night songs differ very much; the day song is given only during sunshine, the other by night and in cloudy weather. I first noticed this while watching one of these little creatures close beside me; as a cloud passed over the sky he suddenly changed his note to one with which I was already familiar, but without knowing to what insect it belonged. At the same time, all the individuals around me whose similar day song I had heard began to respond with the night cry; the cloud passed away, and the original note was resumed on all sides. Judging that they preferred the night song to that of the day from their increased stridulation during the former period, I imitated the night song during sunshine, and obtained an immediate response in the same language; the experiment proved that the insects could hear as well as sing.

This species is exceedingly shy, and the observer must be patient who would hold converse with it. One insect which I had disturbed, and beside which I was standing, could not, at first, decide to resume his song; he was afraid of the intruder, but enticed by a neighboring songster, gave utterance several times to a barely discernible, short click, or *ti:* after five or six of these efforts, his desires overcame his fears. The note by day is *bzrwī*, and lasts for one third of a second.



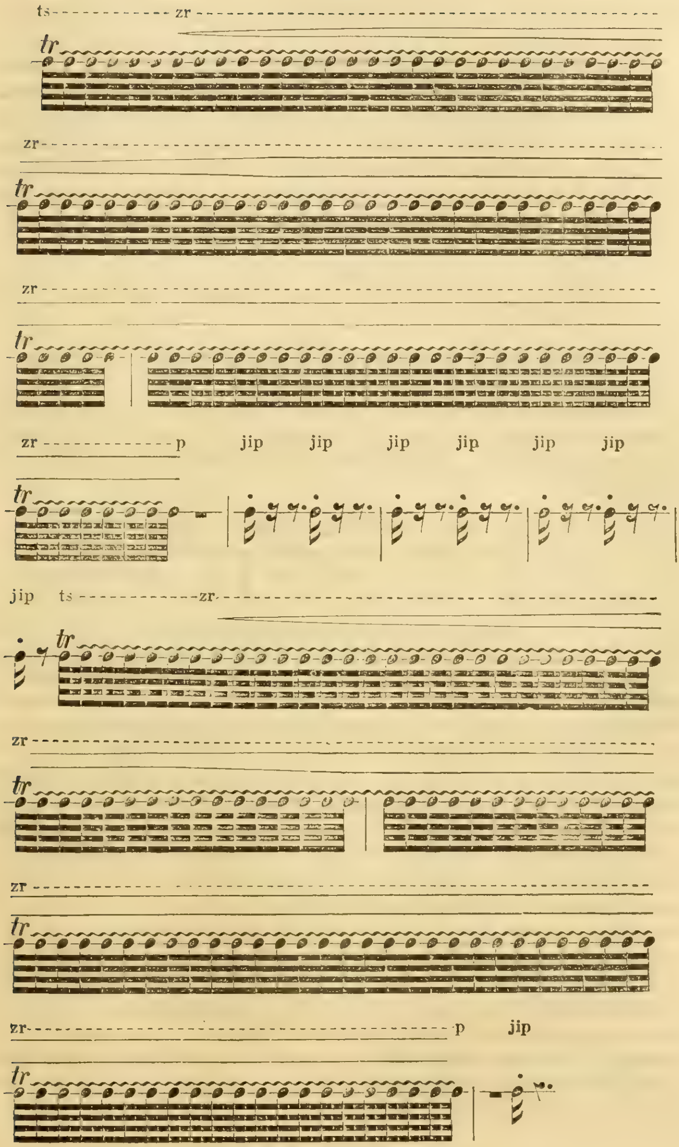
Note of Phaneroptera curvicauda by day.

The night song consists of a repetition, ordinarily eight times, of a note which sounds like *tchw*. It is repeated at the rate of five times in three quarters of a second, making each note half the length of the day note.



Note of Phaneroptera curvicauda by night.

The song of the common meadow grasshopper—*Orchelimum vulgare*—is more complicated. Commencing with *ts*, it changes almost instantly into a trill of *zr;* at first there is a crescendo movement which reaches its volume in half a second; the trill is then sustained for a period, varying from one to twenty seconds (generally from six to eight seconds) and closes abruptly with *p*. This strain is followed by a series of very short staccato notes sounding like *jip!*, repeated at one-half second intervals; the staccato notes and the trill alternate *ad libitum.* The staccato notes *may* be continued almost indefinitely, but are very rarely heard more than ten times in succession; it ordinarily occurs three or four times before the repetition of the phrase, but not more than two or three times when the phrase is not repeated. I have known it to be entirely omitted, even before the repetition of a phrase. The interval between the last *jip!* and the recommencement of the phrase never exceeds one quarter of a second. The night song differs from that of the day in the rarer occurrence of the intermediate notes and the less rapid trill of the phrase; the pitch of both is at B flat.


ts
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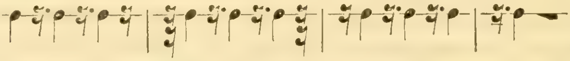
Note of Orchelimum vulgare.

Xiphidium makes a note very similar to that of *Orchelimum*, but so faint as to be barely perceptible, even close at hand.

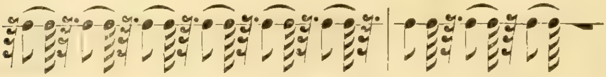
There is a species of *Conocephalus* (*C. ensiger*) which is found all over New England, but I have not heard its song. *C. robustus*, however, which makes the southern sea beaches of New England resound with its shrill, incessant din, could hardly fail to attract attention. It is heard equally by night and day, and the resemblance of its song to that of *Cicada canicularis* is quite striking. The note often lasts for many minutes, and seems, at a distance, to be quite uniform; on a nearer approach, one can hear it swelling and decreasing in volume, while there is a corresponding muscular movement from the front of the abdomen backwards, two and a half times a second. This is accompanied by a buzzing sound, quite audible near at hand; it resembles the humming of a bee, or, as Mr. Sanborn has suggested to me, the droning of a bagpipe.

The *Acrydii* stridulate only by day; of those genera which stridulate by rubbing the hind femora against the elytra, I am acquainted with the notes of but two—*Stenobothrus* and *Arcyptera*. The *Stenobothri*, when about to stridulate, place themselves in a nearly horizontal position, with the head a little elevated; they then raise both hind legs at once, and grating the thighs against the outer surface of the elytra, produce notes which, in the different species, vary in rapidity, number and duration. The first one or two movements are frequently noiseless or faint. *S. curtipennis*, abundant everywhere in New England, produces notes in sunny weather at the rate of about six a second, and continues them from one and a half to two and a half seconds. When the sky is overcast, the movements are less rapid.



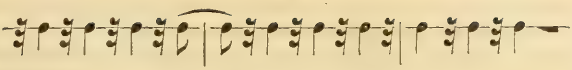
Note of Stenobothrus curtipennis.

S. melanopleurus, as I have proved by many examples, makes, in the sun, from nine to twelve notes, at the rate of fifty-three in fifteen seconds; the usual number of notes is ten.



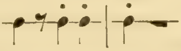
Note of Stenobothrus melanopleurus in the sun.

In the shade the rate falls to forty-three in fifteen seconds, the number of notes remaining the same.



Note of Stenobothrus melanopleurus in the shade.

The stridulation of the *Stenobothri* is never very distinct, but in *Arcyptera lineata*, a very shy species, it can be heard at a distance of fifty feet. These insects usually make four notes, but the number is sometimes greater. The first, a quarter of a second in length, is duller than the others, and followed by a pause of a quarter second; the other notes are of the same length, but sharply sounded, and follow each other rapidly.



Note of Arcyptera lineata.

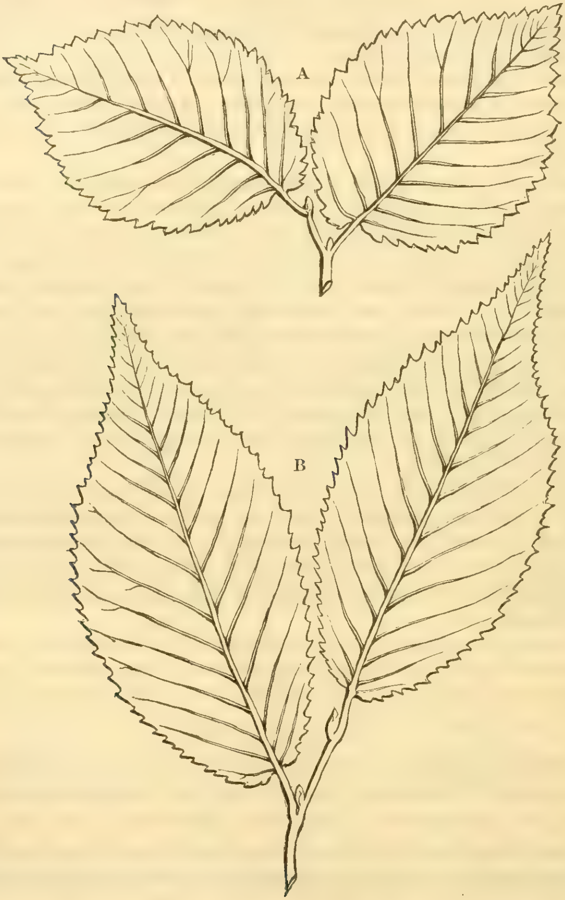
Those *Acrydii* which produce sounds by rubbing their wings and elytra together, stridulate only during flight, and are nearly all confined to the genus *Œdipoda;* their hind wings are often brilliantly variegated. These insects seem to have the sound under control, for although they generally make it during flight, they may omit it when frightened. *Tragocephala viridifasciata* and *Œdipoda sordida* produce this sound during the whole of their undeviating flight; the note is perfectly uniform. *Œdipoda verruculata*, *æqualis* and others, stridulate only during intervals of flight, and seem to exercise the power more at will; the flight of these insects is well sustained, and they are capable of changing their course; at each turn, they accompany the movement with a swoop-like curve, and emit a crackling sound, which lasts but a portion of a second. *Œdipoda carolina* makes a similar movement, but accompanies it simply by a muffled, rustling sound. Other species of *Œdipoda*, such as *Œ. pellucida*, produce no sound whatever.

November 6, 1867.

The President in the chair. Sixty-three members present.

Dr. B. G. Wilder spoke of symmetry and of distorted symmetry in animals and plants, especially in the leaves of the elms, and of the hop-hornbeam.

In all these trees one side of each leaf is larger than the other; but in the elms (*Ulmus*) the larger side is the *upper* or *inner* side, the one nearer the stalk, while in the hop-hornbeam (*Ostrya virginica*) the preponderance, though less marked, is upon the *outer* side, the inner being the smaller. In both, the leaves alternate upon the stem, and every two successive leaves constitute a symmetrical pair, their



outer halves repeating each other in opposite directions, and their inner halves in like manner, just as is the case with our two eyes. The accompanying figures show the above mentioned differences.

In the elm leaves the veins of the outer side are, of course, in advance of the corresponding veins on the inner and larger side; and in the *Ostrya* the reverse is to be seen, though less readily, each vein of the inner side being (at least in the basal portion of the leaf,) a little in advance of the corresponding vein on the opposite side of the midrib. And in both kinds of leaves the difference is sufficiently plain to enable one to distinguish them as "rights and lefts," even when separated from the stem.

Some other leaves, as, for instance, those of the *Begonias*, have already been noticed to present even more marked differences in the size of the two halves, and there have been offered two explanations of the fact.

De Candolle thought that it was due to the position of a leaf upon the stem, and that, therefore, the lower or outer side was always the larger: that this explanation is not sufficient is shown by the fact that all elm leaves have the *inner* or *upper* side much the larger.

Herbert Spencer believes that it is caused by the shading of one, or the other half of each leaf, by the leaf above, and that the half so shaded from the sun is less developed than the other: to this one may object, that the same difference in the size of the two sides exists, when, from the peculiar position, or smallness of its neighbors, a leaf is not shaded at all; and also the same difference is found on examining the embryo leaf in the bud long before either heat or gravitation could have any effect.

Spencer being a believer in "variation through natural selection," would meet these objections with the doctrine that, although the leaves of the first elms which grew may have been symmetrical, yet that, in successive generations, the effect of the shading had become so established as to be transmitted, and thus exist independently of the original cause.

I believe, however, that such peculiarities are true and original characteristics of the plants, and that they are produced by the so-called vital force acting in a definite way, and independently of either heat or gravitation.

Professor Agassiz remarked that the German botanists, and especially Schimper and Braun, had long since investigated the development of leaves in connection with the general subject of phyllotaxis. They had found that each leaf was primarily a swelling or wave of growth, freeing itself from the axis of the embryo, and that differences in size between the sides of a leaf were caused by the greater force of the wave in its ascent or descent; such peculiarities as have been pointed out between the leaves of the hop-hornbeam or the elm, existed, therefore, in the earliest formation of the leaf, while yet connected with the axis by a broad base, and before any constriction for the petiole had taken place. Professor Agassiz thought that the inverse relation of corresponding parts on opposite sides of a line, was better expressed by the word antitropy—proposed by Schimper and Braun—than by the word symmetry, which is employed in very different senses.

Mr. S. H. Scudder repeated his remarks on the stridulation of grasshoppers, given at the last meeting of the entomological section. He also illustrated on the black-board the structure of the stridulating organs, showing the distinction between the singing males and the voiceless females in the same species.

Professor Agassiz inquired whether the size of the cavities of the tubes which formed the framework of the wings had anything to do with the pitch of the notes produced by different insects. He had observed great variety of size in the tubes which he had examined.

In reply, Mr. Scudder referred to a statement of Professor Agassiz that every vocal family of animals uttered its distinctive cry. In the same way every family of grasshoppers could be recognized by the peculiar pitch of its note, even when the species was unknown; and since the pitch was common to all members, great and small, and the diameter of the tubes bore usually a regular proportion to the size of the insect, the pitch could not depend upon the size of the tubes alone. It was probably more closely connected with the delicate vibrating membrane of the wing, for, in crickets, where the pitch is highest, the stridulating surface is much larger than in any other family of *Orthoptera*, while the note is lowest in the jumping grasshoppers, where the vibrating space is broken up by many cross veins.

In fulfillment of his promise at the previous meeting, Professor Agassiz brought forward the results of an examination of the skulls of the American bison and the European aurochs.

He said that it was necessary to reëxamine the proofs of their specific distinction adduced by American writers, because Brandt had recently denied their accuracy. Professor Agassiz stated that, if the way in which species had been separated during the last half century, in accordance with the principles carried out by Cuvier in his Recherches sur les Ossemens Fossiles, was to be considered as a standard of scientific accuracy, then the bison and the aurochs were certainly two species. By some writers, these animals had been considered generically distinct from our domestic cattle, under the name of *Bison*, while the name *Taurus* was applied to the common oxen. The musk ox is designated by the name of *Ovibos*, that of *Bubalus* retained for the buffaloes of India and Africa. In the group to which the European and American bison are referred, the skull projects backward beyond the horns, and the top of the head between them is rounded. In the group including our cattle, there is no such projection of the skull, and the back and top of the head meet to form a sharp, straight ridge, between the horns; the united parietal bones are also developed into a triangular wedge-like piece, unlike that of *Taurus*. Professor Agassiz said he was inclined to believe that these distinctions had a generic value. He then proceeded to point out the following distinctions between the skulls of the American and European Bisons, specimens of which were exhibited.

	AMERICAN BISON.	EUROPEAN AUROCHS.
Muzzle formed by the intermaxillary bones.	**Broad and square.**	**Extended, tapering to a rounded edge.**
Triangular projection of united parietals.	**Regular, tapering to a point.**	**Tapering gradually, not to a point, and ending in a transverse suture.**
Form of lachrymals.	**Advance over the upper maxillaries, reaching nearly to the opposite edge ; bone very obtuse.**	**Advance only half way toward the opposite edge of upper maxillaries ; bone almost square.**
Upper portion of forehead.	**Not prominent.**	**Rising and prominent.**
Root of nose.	**Flat.**	**Prominent.**
Choanœ.	**Square, and cut transversely.**	**Oval, running to palate.**
Temporal depression.	**Broader than in the European species.**	
Space occupied by three foremost grinders.	**Smaller in Bison than in Aurochs.**	
Toothless portion of jaw.	**Larger in Bison than in Aurochs, particularly in lower jaw, the end of which is dilated.**	

The conclusions to which we necessarily come concerning the specific relations of these animals, gives additional interest to the question of the range of our bison in ancient times. In Europe, remains of an aurochs, described by Bojanus as a distinct species, were found in connection with those of the extinct mammoth, but recent observers question the specific difference. In our country, the species of bison found associated with the extinct mastodon has been considered by Dr. Leidy as distinct from the living one.

Professor Agassiz also brought to the notice of the Society the discovery of a Cetacean, new to America. The skull was exhibited, and its peculiar features pointed out. It was obtained on the coast of Nantucket by Messrs. H. M. and S. C. Martin of Roxbury. It belonged to the genus *Mesoplodon*, as characterized by Gervais, and ought to be separated from the fossil *Ziphius*, described by Cuvier. Professor Agassiz, however, questioned whether *Mesoplodon* was not identical with *Delphinorhynchus*, previously described by De Blainville. The specimen found at Nantucket measured sixteen feet in length.

Dr. D. Humphreys Storer placed upon the table a copy of his final "Report on the Fishes of Massachusetts," and as a long period had elapsed since the paper was commenced, he felt that justice to himself demanded an explanation.

In 1837, Mr. George B. Emerson, then President of this Society, was exceedingly anxious that a zoölogical survey of the State should be made. No difficulty existed in obtaining the services of those who were interested in the mammalia, birds, insects and mollusca; but no member of the Society had studied Ichthyology or Herpetology. At the earnest request of Mr. Emerson, I was induced to undertake the duty of studying our fishes and reptiles. The task was an arduous one. I did not know of, nor could I learn that, an Ichthyologist resided in the United States. I could, therefore, refer to no one for advice or aid. I began the study alone, and in a little more than a year after my appointment as one of the Commissioners on the Survey, presented my report, which included every species at that time known to be found in our waters.

No figures accompanied this report, and in 1841 I was requested by a vote of the American Academy, to prepare a report which should be illustrated by plates. I at once commenced the work, redescribed my species from recent specimens, and had my species figured. The difficulty of preserving good specimens of some of our most uncommon fishes was oftentimes great, and of obtaining specimens of the various species greater still. Not unfrequently, fine specimens would be lost, from the impossibility of procuring an artist to draw them.

In 1847, I had completed my work, and it was presented to the Academy. Its publication commenced in 1853, in the fifth volume of its Memoirs. From the fact that others, in many respects more valuable papers, have been constantly presented for publication by the members, and that the expense of my report has been very great, it has been continued in succeeding volumes, until it is concluded in the ninth.

I have felt it my duty thus to speak, that all who may have been, however slightly, interested in the appearance of this work, might know I had not faltered in the undertaking, but the delay was unavoidable.

November 20, 1867.

The President in the chair. Forty-six members present.

Dr. J. W. Dawson of Montreal was elected an Honorary Member.

Dr. Samuel Kneeland read a paper on the relation of the plumage of birds to their modes of nidification. At a recent meeting of the British Association for the Advancement of Science, a communication on the same subject was offered by Mr. A. R. Wallace. According to him, birds' nests may be divided into two classes: those which are exposed or imperfectly concealed, and those which are covered, or so placed that the sitting bird is effectually hidden. Birds also may be divided into two groups, according to the difference of coloration in the sexes. In some species varied and brilliant colors occur in both sexes; in others, a more numerous class, the male is brighter than the female. With but few exceptions, Mr. Wallace finds that birds of conspicuous color build concealed nests, while in species where the female is dull, the nest is fully exposed. Dr. Kneeland brought the birds of our own country under a hasty review, and attempted to show that we should find the same remarkable provision for the protection of the mother bird and her young.

The diurnal birds of prey, as eagles, vultures, and hawks, make their nests in inaccessible places, and beside being rarely of bright colour, are well armed for the defence of their young.

The nocturnal birds of prey, less well armed, less wild in their habits, and less able to fight any enemies in the day time, and also more conspicuous, build their nests in hollow trees or underground or amid thick foliage.

The *Caprimulgidæ*, or goatsuckers, make no nest, laying their eggs on the ground; both sexes are alike, of sombre and inconspicuous colors; the eggs and young find their protection in their color resembling that of the ground.

In the swallows, both sexes are nearly alike; they are protected by nests in hidden or inaccessible places.

Among our birds, in which the females are bright or conspicuous, and which accordingly conceal their nests, or make them of a color to deceive or of a form or depth to hide the sitting birds, are: the kingfisher, woodpeckers, Carolina parrot, Baltimore oriole, humming birds, magpie, purple grackle; azure, autumnal, and black and yellow warblers; song and fox-colored sparrows; Savannah finch, towhee bunting, black-capped and chestnut-crowned titmice; meadow lark; black and white creeper; red-bellied and white-breasted nuthatch; golden crowned thrush; Zenaida dove; wild turkey; quail; Canada, pinnated, and willow grouse, and summer duck.

Among our birds in which both sexes are dull, and a concealed nest is unnecessary for the protection of the young, are the families of thrushes and vireos, and the passenger pigeon. Among those, in which the male is bright, but the female dull, are the yellow-breasted and many other warblers, the gold-finch; the blue, rose-breasted, and cardinal grosbeak; the scarlet tanager, redstart, orchard oriole, bobolink, painted finch, indigo bird, red-winged blackbird, kingbird, blue-grey and other flycatchers, the ruffed grouse, etc.

The blue and Florida jays, in which the females are nearly as bright as the males, form an apparent exception in making an open nest; but the bold and watchful habits of these birds, their size and strength, their neighborhood to houses, and their congregation in companies, would render any further protection unnecessary. Other exceptional examples, which more extended inquiry would doubtless furnish, could probably be explained by the peculiar habits of the species.

The wading and swimming birds have not been included in this comparison; they usually breed in inaccessible or secluded places, or in high northern latitudes, or in such multitudes together that their very numbers afford a sufficient protection, or render the losses they sustain from carnivorous enemies of comparatively little consequence in the preservation of the species; they are, moreover, usually not bright, and the eggs and females are generally colored like the surroundings of the nests.

Another interesting coincidence, if not showing the relation of cause and effect, is that in the concealed or concealing nests, the eggs, as a general rule, are white—as in those of the owls, swallows, kingfishers, woodpeckers, humming birds, quails, and doves.

Mr. Wallace, being a Darwinian, would explain this curious and unexpected connection between the manner of a bird's nesting and the color of the female plumage, by the laws of variation and hereditary transmission, and the cumulative effect of natural selection or survival of the strongest, and as illustrating how large a part the need of protection has played in producing many of the most striking peculiarities in the animal kingdom.

Mr. W. T. Brigham read a paper upon the form of volcanic craters as influenced by a supposed line of fracture in the earth's crust.

All large craters are oval or elliptical, and it is exceedingly rare to find one of circular form. It is inferred that the elongated shape is due to their formation over a longitudinal fissure. Where this crack is widest the larger portion of the crater will be found. On examining the direction of some of the principal lava craters a curious fact is observed; they are generally at right angles to the general line of volcanic vents. Thus the crater of Antuco, one of the loftiest of the southern Andean volcanoes, has its major axis in an east and west line, while the Andes range nearly north and south. Gelunggung in Java, has a huge crater opened towards the north, while the Javan line is an east and west one. The same is true of Orizaba in the Mexican chain of the 19th parallel. Santorini and the other islands of the volcanic band of the Grecian Archipelago, which trend north-west and south-east, have their major axes at right angles to this general direction. So is it with Vesuvius, with Ætna, and Teneriffe, and, so far as I am aware, with all known volcanoes. Unfortunately, the information we possess of the direction of the elliptical craters is very scanty, as attention has not been turned to this matter. When sufficient data shall have been obtained I believe the direction of the major axis will determine the direction of volcanic trains and thus of the rents in the earth's crust, and remove much of the obscurity now attending the physical geography of volcanoes.

Why should the line of ejection be at right angles with the general train? The longitudinal crack which is marked by a line of volcanic vents, is simply a fissure in the lowest portion of the earth's crust; if this were not so it would give rise to a crowded, unbroken line of vents which would be in feeble, simultaneous and almost constant action. The result of this fracture on the superior portions of the earth's crust is, however, a series of transverse fissures, nearer to each other where the inferior main fissure is widest. The relation these transverse fissures bear to the main line of dislocation is not yet understood, although the fact of their existence has long been recognized. I do not by any means attempt to explain this; I only wish to point out what has not before been noticed, that in all cases where the direction of the major axis of a crater is known, it is at right angles to the general trend of the volcanic series to which it belongs.

Professor Agassiz read a notice just received from Sir Roderick Impey Murchison, intended as an appendix to the last edition of his Siluria.

It stated that certain rocks of Scotland, heretofore claimed to belong to the New Red Sandstone, had been shown to be Triassic—only two fossils had been found in them and as these were of genera not occurring in other rocks it was impossible to speak with certainty of their age. The first was a fish described by Prof. Agassiz in 1836, under the name of *Stagonolepis Robertsoni*, and the other a reptile subsequently called *Telerpeton Elginense* by Dr. Mantell. Since the discovery of the reptile, then considered the oldest known in the world, Prof. Agassiz had refused to believe in its asserted antiquity, because he believed that asserted facts could not be received when they conflict with all serial experience. Now by the researches of Huxley, the reptile was proved to be identical with one found in Triassic rocks on the continent of Europe and closely allied to others found in beds in India which lie near the Trias.

Dr. J. Wyman gave the results of the measurements he had made of some of the human crania, viz.: of Whites, Hawaiians, Hindoos and North American Indians of different races, with reference to the position of the union of the spinal cord with the brain, as indicated by the position of the opening at the base of the skull through which the cord passes. It was asserted by Soemmering that this was further back in the

Negroes than in the other races, and therefore in this respect the former were nearer the apes. It appears, however, that Soemmering's statement is incorrect. The races mentioned above, arranged according to the position of the opening referred to, would stand in the following order: Whites, Negroes, Hawaiians, Hindoos, North American Indians; these last, in this one anatomical peculiarity, being the most ape-like.

The Corresponding Secretary read a list of letters received since the last announcement; among them one from Mr. W. H. Dall, announcing his intention of remaining in Alaska to continue his explorations, and giving some account of the scientific work of the Telegraph Company during the past year.

The Custodian announced the donation by Mrs. Bryant of the large and valuable series of the nests and eggs of American birds collected by the late Dr. Bryant.

Section of Entomology. November 27, 1867.

Mr. P. S. Sprague in the chair. Nine members present.

The following paper was read by Dr. Herrmann Hagen:—

I beg leave to present this communication of a very interesting fact in the Biology of Insects. It relates to the mode of locomotion in *Chelifer* and other Pseudoscorpions. I am indebted to Mr. Lyman for the accompanying specimen of a Fly with two Chelifers strongly attached to his legs. Although the discovery is not very new, I think it is little known. I have found in Entomological Literature the following remarks upon the same subject.

Hermann (Mémoire aptèrologique, Strasbourg, 1804, p. 117) has found one *Chelifer* attached to the leg of a Fly, whence he has named it *Chelifer parasita*, but Latreille thinks that it is the same species as *Chelifer cimicoides*.

Leach (Zoölogical Miscellany, 1817,) has also seen the Chelifers attached to flies.

Haldeman (American Journal of Science, 2d Series, Vol. VI, p. 24) writes of a parasitic *Chelifer* found under the Elytra of *Alaus oculatus*; and in the London Magazine of Nat. Hist., Vol. IV, p. 94 and V, p. 754, it is communicated anonymously that *Chel. cancroides* is often found parasitic on Diptera, principally on flies.

In the same magazine, Vol. IV, p. 283, these statements are doubted, but were still maintained by Mr. Laxis. He repeatedly found *Chel. cancroides* and other species attached to the legs of *Musca larvarum*, *domestica* and *meteorica*, principally in hot weather. Mr. Clapton once found four Chelifers attached to one leg of a fly. Another naturalist has found *Chel. cimicoides* on *Stomoxys calcitrans*. The latter communications are repeated in Wiegman's Archiv, Vol. I, 2, p. 186, with the observation that the *Chelifer* used the fly as a means of changing his place of living.

Many years since I myself received three Chelifers from Venezuela with the annotation, "found parasitic under the elytra of *Acrocinus longimanus*."

When I first saw the fly given by Mr. Lyman I noticed but one *Chelifer*, but by the aid of the microscope, I found another *Chelifer* attached to the same leg. This was apparently a *voyage en famille*.

Why *Chelifer* should be attached to other insects is still unknown. Of the opinion maintained by many authors, that this is an act of parasitism, I have very great doubts. It is true that the *Chelifer* eats by sucking, but it is very doubtful whether it would choose for its food animals whose segments are very thick compared with the power of the minute *Chelifer*. I think that the segments under the elytra of *Alaus oculatus* and of the gigantic *Acrocinus longimanus* could never be perforated by the very small and soft maxillary apparatus of the *Chelifer*. The legs of the Flies are also too tough for its food, and the Chelifers are always found attached to the legs and not to the softer abdomen. Many authors have observed that *Chelifer* eats the little *Atropos pulsatorius* (death watch), and this is probably suited to its power and size.

In consideration of these facts I think it more probable that the opinion given in Wiegman's Archiv is correct; that the *Chelifer* used these animals as an expeditious means of changing his location, that he might find elsewhere more and better food.

I am not quite certain of the systematical name of the species kindly presented by Mr. Lyman. So far as I know there exist but three species described from America, two by Mr. Say, and one, constantly overlooked, by Linné or De Geer. In the Journal of the Academy of Natural Sciences of Philadelphia, 1821, I, p. 63, Say has described *Chelifer muricatus* and *Chelifer oblongus*. The first cannot be our species, because Say says that the third joint of its palpi is nearly three times as long as the second. It is possibly the second species, but I would not detach the animals for an accurate examination before the Section had seen it. The third species was described by Linnæus in his 10th Edition of the Systema Naturæ as *Acarus scorpioides* from Surinam and in the 12th Edition, as *Phalangium acaroides.* De Geer in his Mémoires, Vol. VII, has described and figured the same species as *Chelifer Americanus.* This was the species which I received from Venezuela.

The fact that an animal changes its location by means of another animal is interesting, and it is evident that this way is taken either from laziness, or from incapacity to accomplish his purpose in any other way. In the *Chelifer*, whose movements are slow, this means of locomotion is apparently adopted to find suitable food more easily. Necessarily such a state of things cannot be unique in natural history. I confess that at present I know nothing analogous to it among insects except the case of the larvæ of *Meloe*, the well-known *Triungulinus*, which creeps upon bees on purpose to be taken into their nests. Something analogous exists, I think, among fishes. *Echeneis remora* is often found attached to other fishes by a peculiar apparatus. But the purpose in the *Echeneis* is not very clear, for this species swims very quickly. The apparatus for the attachment of *Cyclopterus Lumpus* is quite different; its purpose is not known.

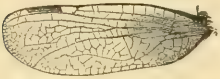
Mr. B. P. Mann said that he had received a specimen of *Alaus oculatus* from Ohio, beneath the elytra of which a *Chelifer* was found.

Mr. S. H. Scudder exhibited a curious specimen of *Diapheromera femorata.*

One of the fore legs, broken off in early life, had been replaced by a new one, less than half an inch in length; the femur was perfectly formed but diminutive, the tibia not quite so long as the femur and a little curved at the tip. The tarsal joints were malformed; the first joint was about one quarter of its usual length; the second joint was wanting; the third, fourth and fifth joints were of about the ordinary size, although the last one was unprovided with either claws or foot-pad; possibly, as in the case mentioned by Newport, it was the third joint that was wanting. The animal had been kept alive for several weeks, during which time she had laid many eggs; her death evidently resulted from the rupture of a membrane while ovipositing, as two eggs could be seen protruding from the extremity of the abdomen at once, one from the usual place, the other from the anal orifice; the first egg was withdrawn into the oviduct by the contraction of the parts in drying, but the egg in the vulva could still be readily seen.

Mr. F. G. Sanborn exhibited a specimen of *Libellula luctuosa* Burm. ♀, presenting a singular malformation, or arrest of development, in the anterior wing.

The wing is comparatively well proportioned from the base to the nodus, though bearing marks of differentiation from the normal arrangement of nervures. The pterostigma, however, is perceptibly shorter and broader than that of the opposite wing, and is situated about one eighth of an inch only from the nodus, only *one* cubital vein occurring between them, instead of *fourteen* as in the opposite wing. The margin is thickened, and the apex of the wing truncated and compressed, as if a crushing force had been applied in the direction of its length and had spent its strength on the external half of the wing.



He also exhibited several specimens illustrating Insect Economy, viz.:—

1. The winter larva-cases of *Limenitis Missippus* shown by Mr. L. Trouvelot at a previous meeting. These cases, composed of the leaf of the willow on which the larva feeds, are neatly joined by their longest opposite margins, so as to form a cylindrical tube closed at one end and lined with the sericeous substance spun by the inhabitant.

2. The larva-skin of an *Œdipoda* impaled on a needle or leaf of pine; these specimens are frequently found, as also the same cast skins impaled on leaves of grass. The head of the insect is always directed toward the base of the leaves so far as I have observed, giving rise to the very natural conclusion that when about to moult the larva pushes its head against the point of the leaf, and crawling onward makes use of the purchase thus obtained in divesting itself of its skin. The specimens thus impaled—so far as observed—were always quite young individuals of *Caloptenus* or some species of *Œdipoda*.

3. Skins of *Aphides* on a poplar twig in great numbers, and two other species on leaves of apple. These skins had been emptied of their contents by a Hymenopterous parasite, *Aphidius*, which had escaped after its transformation by gnawing a nearly complete circle through the dry skin, thus partially detaching a neatly rounded lid or cover, which hung by a small portion of its circumference as by a hinge.

4. Two acorn-cups which had been made use of by spiders, one as a retreat, the opening of the cup being flatly roofed over with web leaving only a small aperture for ingress and egress. The spider

was believed to be of the genus *Attus*, but as it unfortunately made its escape from the collector, its identity could not be ascertained.

The other cup, roofed in a more close and substantial manner exhibited no opening whatever, and when an artificial one was made, no spider, young, or eggs, in fact, nothing whatsoever, was discovered within to give a clue to the object of the industrious spinner. It was considered that this was probably an instance of a curious instinct of barren females who sometimes expend a great deal of labor and time in preparing for an imaginary future progeny.

Dr. E. P. Colby exhibited a specimen of the exceedingly rare *Coccinella similis* of Randall, which he had obtained on the summit of Mt. Ascutney, Vt.; only one or two other specimens were known. Randall obtained his single specimen on Chelsea Beach, where it had been washed up, and Mr. Sanborn had found one specimen, now in Dr. LeConte's collection,on high ground in Medford.

December 4, 1867.

The President in the chair. Forty-eight members present.

The following paper was read by the Secretary :—

SOME NOTES OF A SHORT JOURNEY ON THE ISLAND OF YESSO AND REMARKS ON THE AINOS. BY ALBERT S. BICKMORE, A. M.

The islands that now form the empire of Japan are four in number: Kiusiu, on the south, opposite Corea; Sikok, a little to the northeast; Nippon, the great island of Japan, to the north; and Yesso, another large island to the north of the latter. In the most southern part of Yesso, on the wide strait, which separates that island from Nippon, is situated Hakodadi, its chief city, and only port open to foreign trade.

Arriving at this place on my way northward from Yedo to Siberia, at the solicitation of our Consul, Col. E. E. Rice, the Governor of Yesso gave me the privilege of going some miles beyond the places usually visited by foreigners, and seeing a real village of Ainos—the aborigines of these islands, and the least known of all the people of the East.

The harbor of Hakodadi is formed by a long spit of sand extending outward from the side of a bay to a high headland, the ruins of an old volcano, which tradition says became extinct some four hundred years ago, after a great eruption, which first raised this sand spit above the level of the sea. The city, which numbers about thirteen thousand inhabitants, is situated partly on the flanks of the mountain and partly along the neighboring shore. With a Japanese, who could speak a little English, for a guide, I started on foot over the low lands that border the bay, and extend back from three to five miles to the flanks of a mountain range between two thousand and three thousand feet in height. A mile from the beach rose a long terrace some twenty feet high, which, in former days, was undoubtedly a bluff by the sea shore. Back of this there is a smooth ascending plain, which, according to subsequent measurements made with an aneroid barometer that had just been tested by the known height of Hakodadi peak, rises to a height of 1180 feet above high water level. The place where the plain attained this elevation bore N. 25° E. from Hakodadi peak, but I afterwards saw another place bearing about N. 20° E. where it probably rose two hundred or three hundred feet higher. The smooth surface of this plain is an indication that it was formed *under water*, from the material washed down from the surrounding mountains, firstly, because the mountains rise up at once from the plain and form a sharply defined angle; and secondly, because if this had been a sub-aerial instead of a marine formation, the loose sand and rocks of which it is composed would have been scored with many small gullies like the present surface of the neighboring volcano.

Along the way we met long lines of pack horses, carrying wood and charcoal to Hakodadi, and in one place a triangular cart on three wheels drawn by a single bullock. Most of the houses we passed had bunches of green twigs hung out in front, as a sign to passers by that saki could be obtained within. A walk of twelve miles took us to Ono, and an old man well acquainted with the neighboring mountains guided me five miles in a northwesterly direction, along a small stream, to an old lead mine. Everywhere terraces appeared, as distinctly defined as any I have ever seen in the upper part of the Connecticut valley. In a small depression on our left, heaps of debris marked where two tunnels were made, but the whole had been so long neglected, that in some places the rock had fallen in, and in others the wooden supports for the hanging walls were completely decayed and ready to fall from their own weight. The few specimens we could gather, all showed that the lead ore (bi-sulphuret of lead) occurs in veins of quartz which intersect masses of syenite. With the lead there is also seen much pyrites, both in the quartz veins and in the syenites on either side.

The next day we travelled five miles to a pass in the mountain range that stretches along the northern shore of Tsugar Strait. From this high point we enjoyed a fine view over the way we had come, while to the northward appeared before us a beautiful lake, shut in by high mountains, and beyond rose the volcano Komanartaki, its naked sides speaking of the continual activity of the fires that gave it birth. Descending to the lake, we followed its shore for five miles farther, when the heavy clouds that had been settling down on the mountain tops, began to pour down in showers the loads of moisture they had brought up from the warmer air of the ocean. The houses now began to be more scattering, and all along the lake we passed but three. In one, by a large brook abounding in fish, we found comfortable quarters, and the following day we set off for the top of the volcano to take advantage of the clear sky given us by a western wind. Our guide took us a *ri* (two and a half miles) farther along the road, then the same distance through a wood of oak, maple and birch, to the foot of a long naked bank of sand and small rounded boulders of pumice stone. The distance thence to the top was a *ri* farther.

As we ascended, the boulders became smaller and smaller, and for the last half of the distance we had to plod on in loose sand, the largest pieces of pumice stone being washed the farther, because when this rock disintegrates into sand it occupies much less space, or in other words, is heavier, than before. In fact, the whole mountain is merely one immense heap of sand of a light red or salmon color. Twelve years ago it had an eruption, and ashes and sand were thrown to Hakodadi. Its present form shows that at some recent period, and probably at that time, the whole mountain was split through from top to bottom in a north-westerly and south-easterly direction, which, it is worth noticing, is just the trend of the coast. If its previous form was that of a cone, as is probable from what remains and the materials of which it is composed, nearly the whole upper third must have since disappeared. The highest point that now remains is 4,188 feet in height, according to the best charts. The present form of the crater is that of an ellipse with a major axis of a quarter of a mile, directed north-east and south-west, but the whole wall on the east side has disappeared, and there is merely a continuous descending plain from near the centre of the crater to the sea shore five miles away.

On coming to the edge of the crater wall, we found within a low, dome-shaped mass of sand, with a deep fissure through it, in the direction in which the mountain must have been rifted asunder. In long seams over the dome and at different spots on its surface, great jets of steam and sulphuric acid gas were pouring out, accompanied with a heavy bubbling or rumbling noise. My guide refused to go down into any part of the crater, but I climbed down a short way and watched the steam and gas rise from the bowels of the mountain.

On all sides the mountain is scored by gullies, where the melting snows and heavy rains have washed down the loose materials. In this way, fully one-half of the basin formerly occupied by the lake has been filled up, and in one place there is a continuous stream of sand from the crater wall to its shore. Like most of the lakes on Nippon this occurs at the foot of a volcano, and its basin was doubtless formed by volcanic agencies.

Acres of tall dead trees rise on the flanks of the volcano and stretch out their gnarled and naked arms as silent witnesses of the devastation caused by the last eruption. Descending the mountain we came to Mori, on Volcano Bay. Here for the first time I had the opportunity of seeing two men and a woman of that strange people, the Ainos.

From Mori we followed the shore for fifteen miles to Ya-ma-Koosh-nai, sometimes over loose sand, shingle or boulders; and sometimes along the little paths that lead from one fishing village to another, in a neighboring bay. Terraces extend the whole way, occasionally coming down to the shore and forming bluffs one hundred or one hundred and fifty feet in height, but back of these was another series as much higher. The fishermen near the head of the bay were taking a fish much like our herring, in great quantities, for their oil. The residue in the boiling pots is pressed into square masses and exported as manure for rice fields. There we saw many Ainos at work with Japanese, but usually they prefer to work in companies by themselves.

From Ya-ma-Koosh-nai we travelled five miles to Urope, a village of three or four Japanese, and about twenty Aino houses. The latter were scattered irregularly near the shore over a broad belt of sand, that has been drifted back by the easterly winds. They all have the same rectangular form, and are similarly situated in respect to the shore.

The best are composed of a house part about thirty feet long and twenty broad. To this is attached a porch about twelve feet long and eight broad, and around the whole is a straw fence. The house and porch are built of a frame work of small poles fastened together with strips of bark and covered with millet straw. The walls are about four feet high and slightly sloping. The roof projects a few inches at the eaves and rises from each side to a point in the centre. In the walls, under the eaves, there are two or three holes of a foot in diameter, which serve as windows. In entering, you pass through the straw fence and into the porch, and thence through a door into the house. The house part is generally all one room, and also the porch; but in a few a kind of partition is made in the larger room by hanging up mats. Most of the houses have no floors, but instead the sand is covered with mats of coarse straw ; on one side of the room there is a platform of boards on stones or blocks of wood, where the occupants lounge and sleep. They usually sit on the mats on the sand. In the centre of the room the fire is made on the sand, and over this and about three feet above it, is a kind of frame-work held up by strings from the rafters, where they place the fish they wish to smoke. It also serves for a cupboard or dresser, where the smaller iron pans and kettles may be put away. There is no chimney, and I did not even see a hole in the roof for the smoke to escape. Everything overhead is, therefore, black with smoke, and generally has a shining, oily appearance. Each house is provided with a few iron pans and kettles of Japanese manufacture, and these, with two or three wooden dippers, and some large valves of the Pecten, comprise their cooking utensils. They make a fire by means of a flint, steel and tinder, which are usually kept in a bag of undressed deer skin. In several houses I saw a considerable number of lacquered dishes, which they had evidently obtained from the Japanese. Near each house there is another small one about eight feet square, perched on a platform five or six feet high, in which they store their fish, in much the same way as the natives of Sumatra preserve their rice. In the first house we entered, the man was seated cross-legged in one corner making spears, with a fire of charcoal and a Japanese bellows. The woman was crouched near the fire, twisting up thin strips of the inner layer of the bark of a tree into a continuous line of the size of a mackerel line. It is from such material, and in this way, that all the lines for their fishing nets are made. They had four children; all boys, the youngest two and the eldest ten. The two younger ones had no clothing on whatever, and the other two were only provided with a long jacket though it was quite chilly. With such exposure evidently a large proportion of their children must perish.

In the next house we entered—the dimensions of which I have given above as a model—we found an old man, his son, and three women. The old man said he was seventy-five, and his white hair and white beard made it appear probable, yet a young woman, apparently of twenty, was presented to me as his wife. She was demurely at work in one corner, making a straw mat after the Japanese style. The other young woman was weaving a piece of coarse cloth about ten inches wide, from strings made of bark as already described. These strings, which represented the warp, were fastened at one end to a post and at the other end to a board which she kept leaning against while she changed them and pushed through the filling and pressed it down with a sharp-edged board. This kind of cloth seems to be the only one they have, and it is all made in this slow and laborious manner. In front of this house, that is, on the side toward the shore, there was a kind of rack filled with sticks, each having on its top the skull of a bear. In this single place I counted twenty-nine skulls, a number that must make our old friend and his son rank high in the estimation of his Aino companions. In another house we entered, we found a man and his wife seated by the fire. The woman was sewing, but the man was doing nothing, and yet the bay was swarming with fish. He showed us the bow he used in hunting the bear, but would only sell a model of it, declaring that in their estimation it was most disgraceful for an Aino to part with the bow he was accustomed to use. However I secured a real arrow. The after part of the shaft was of reed, the fore part of solid wood to make it fly point foremost, and the barbed part of bamboo. They carry short knives, but they appear to rely on their bows and arrows when they attack a bear or kill a deer. I saw no lances, nor any implements of stone or bronze. I also purchased of this man a pair of snow shoes, each made of two strips of wood bent like an ox bow, with the straight part fastened together with deer skin. The woman sold me a short knife, with a scabbard of wood and ivory, rudely chased. It was the only piece of ornamented work I saw. As I was anxious to ascertain the height, the distance round the chest, and the length of the arm, hand, and foot of an Aino woman, my interpreter bribed the husband with a small piece of silver to make the desired measurements, but the paper was unfortunately lost, and now I can only state from memory, that the peculiarity which struck me most was, that the regions of the waist and chest did not appear as separate as in most women; but it remains to be seen whether this is a permanent character. The mammæ were very largely developed, and gourd-shaped.

When a woman marries they tattoo her upper lip and sometimes the under one also. A favorite pattern has the ends curved up, in just the way exquisites sometimes curl up the ends of their moustaches. Several times I inquired what was the cause or origin of this strange custom, but invariably received the unsatisfactory answer—"because it is the Aino fashion"—which, is perhaps, as good a reason as could be assigned for a thousand foolish customs in the most civilized lands. At all events it gives these Aino women the appearance of trying to add to their charms by artificially making up for what they seem to consider a defect in nature's handiwork. The women also tattoo the backs of their hands in narrow transverse bands, but no other parts of the body. They never blacken their teeth or compress the feet. In each Aino village, the oldest man, or a very old man, is the chief, and he in turn is responsible to a Japanese official styled "the Aino Interpreter." As the chief was away fishing, we called on the

Interpreter, who was also absent, but a sub-official gave me some farther items in regard to the strange people under his charge. They cultivate millet and potatoes, but no rice. In one hut I saw the thick midrib of some wild plant finely chopped. When they kill a bear, they are allowed the head, but the skin belongs to the Interpreter. They are permitted, however, to wear deer skin, and the woman I saw first at Mori had on an outer dress of that kind. It is said that when young cubs are found they are brought home and nursed by the Aino women like their own children, but this is quite incredible.

Returning to Ya-ma-Koosh-nai, I continued on to Mori, and made that day twenty-five miles, over the sand, rocks and shingle. The next day I reached Hakodadi, thirty-two miles—whole distance on foot in six days, one hundred and thirty miles. On my return I found that eight Ainos had just arrived in a couple of junks from a place on the south coast, a short distance east of Endermo Bay. With the prospect of a small present they readily came to the residence of Colonel Rice, whose kind hospitality I was then enjoying. They all sat down cross-legged, in the Turkish style, not in a semicircle like our American Indians, but in a straight line, the oldest man on their extreme left, the highest position of honor, and the rest ranging themselves according to their ages, to the youngest on their right. They could not tell, however, how old they were, but said the Japanese officials kept a record of their ages. As soon as they were seated they began their salutation, which consists in slightly inclining the body forward, at the same time raising both hands as high as the eyes, with the palms inward and the fingers extended and nearly touching each other. The hands then pass down along the beard to the chest. This is repeated three times, and when they wish to show still greater respect they accompany these motions with a low guttural muttering. Saki (Japanese rice-whiskey) being their favorite drink, each was offered a glass and a chop stick. Taking the glass in the left hand and the stick in the right, they dip the end of the stick into the liquor they are about to drink, and slightly raising it describe a circle with an upward and inward motion. While describing these motions with the stick, they uttered a long prayer, in a low monotonous tone. This prayer, they afterwards informed us, was not in our behalf, in return for the saki, but addressed to the God of the sea, asking that they might be preserved in their boats, and find an abundance of fish. One of their number spoke Japanese fluently, and Mr. James J. Enslie, the Japanese interpreter at the British Consulate, and himself the author of two interesting papers on the Ainos, kindly volunteered to ask them a list of questions I had prepared. In this way the following information was obtained directly from the Ainos themselves. As some of the questions proved somewhat perplexing, they became tired before the list was completed, and I failed, therefore to get replies to all my queries.

They have many gods, but fire—not the sun. the moon, nor the stars—is the principal one, and they are accustomed to pray to it in general terms, for all they may need. They do not buy their wives, but are expected to make presents to her parents of saki, tobacco, and fish. At their marriages they make no great rejoicing or display. Their only feast is at the beginning of the new year, when they make offerings to all the gods. When a wife dies they burn the house in which she lived, but when a man dies they bury him without any funeral ceremony, (perhaps the Interpreter meant if he was a common man). To inter a body they dig a hole in the ground and lay in planks in the form of a box. The body is then clothed in *white*, and placed in at full length, with the head to the east, "because that is where the sun rises." A widower may marry again in two or three years, but a woman can only marry once; (this the Interpreter probably intended to say was their law but not the universal custom). A man can have but one acknowledged wife, but any number of concubines, each of whom always lives in a separate house. At present they have no king, but a great chief living at Saroo. The Interpreter had met other Ainos whom he could not understand; (that is to say, there are at least two different dialects in the Aino language). They keep no cats but catch rats in traps. They have "only Japanese horses." They keep fowls but no ducks. They eat their fowls and what wild birds they can take, but never eat *eggs*. They have no special burying grounds, and they desire only to forget their deceased relatives as soon as possible. They never speak of the dead, and if a man should call on a friend, and inquire for his deceased wife and say "Oh! is she dead?" such an act would be considered the grossest breach of good breeding. They say they can make poison, but refused to tell how, and farther declared that they kept it such a secret that even the Japanese officials knew nothing of the process. They have sorcerers whose advice they are accustomed to ask. A Japanese doctor who had lived long among them told me that when a man was lost at sea or among the mountains, his wife cries, and all her neighbors beat her with sticks to make her forget her sorrow. When the Interpreter was asked what would become of him after he died, he replied he did not know; and when he was asked if he expected to go to a place of happiness or a place of misery, hereafter, he simply laughed as if he did not understand the question or thought it extremely foolish. They have no written characters, and only oral traditions.

After these questions I took the following measurements of the interpreter, his companion, and two of a man seen at Mori.

	Interpreter.	*Companion.*	*Man at Mori.*
Height	5 ft. 1¾ in.	5 ft. 2 in.	
Around the head horizontally above the eyebrows	1 " 10¾ "	1 " 10 "	
Around the chest immediately beneath the arms	2 " 10 "	2 " 10½ "	2 ft. 10⅝ in.
Around the abdomen at the navel	2 " 7½ "	2 " 9¼ "	
Length of the arm to the end of the middle finger	2 " 2½ "	2 " 4½ "	2 " 1¾ "
Around the arm at the largest part,	10¼ "	10¼ "	
" " fore arm	10⅛ "	10⅝ "	
" " leg at the calf,	12½ "	1 " 1½ "	
Length of the foot	9½ "	9⅞ "	
Around the foot at the instep, vertically	10⅛ "	10 "	

These measurements were made from men of medium size. They show, therefore, that although the Ainos are stout and strong, they are hardly taller than the Japanese, and not near as tall as the average of the people in the north of China. The relative size of the hands and feet to the rest of the body seems to vary considerably. I saw no lame persons and but one man who complained of being ill, though several had evidently reached an advanced age.

Their chief peculiarity is the great development of their hair, not only on the head and face, but over the whole body. Their eyebrows and eyelashes are very thick, and like their beards and hair, always of a jet black, till past middle life, when, as with us, they change to gray and in extreme old age to white. Their hair appears coarse compared with ours or with that of the Japanese. They wear it long—down to the shoulders. The men wear theirs as long, or longer than is the custom with their women. Their eyelids are horizontal and open widely, as in the Indo-European races, and are not oblique as in the Mongols, Manchus, Chinese, Japanese, and also the Coreans, all of which peoples it has been my privilege to see in large numbers. Their eyes are bright and sparkling and always black. The fine development of their chests, with their full, heavy beards, gives them the appearance of noble and hardy men as compared with their effeminate Japanese rulers. They seem to be endowed with great vitality, and the fact that they so successfully resisted the repeated attacks of a more enlightened race for eighteen hundred years, sufficiently proves their daring and perseverance.

The dress of the men consists of a strip of cloth covering the loins in the same way as is customary among coolies in the East. In summer this is their only clothing, but in winter they wear long, loose coats, or dressing-gowns, woven from strings of bark. This is folded over from right to left* and bound at the waist with a sash. Their heads, feet, and legs are usually bare. The women have a short sacque coming down to the hips, and beneath this a piece of cloth wrapped around the waist and hanging down nearly to the knee.

As they have no written records, the earliest accounts of this people have come down to us through Japanese histories. According to a Japanese chronology, compiled from the best sources and kindly translated for me by Father Nicholai, of the Russian Legation, Jin-mu, the first Japanese emperor, appeared on Kiusiu at Hunga (or Hewng-nga) in B. C. 667. In B. C. 663, he first came to Nippon, but was defeated and driven back by the aborigines. In B. C. 660 he returned and effected a permanent settlement on the south-east part of that island. In most of the Japanese histories, at least, no mention appears of the arrival of any new people, and the Japanese all believe that these aborigines were the ancestors of the present Ainos. Thus this people, although so little known to this day, are mentioned half a century before the time of Nebuchadnezzar, and six hundred years before the northern and western parts of Europe were first described by Cæsar in his Commentaries, and more than two thousand one hundred years before the discovery of the continent by Columbus. In A. D. 272 the Ainos, for the first time, brought presents to the Japanese authorities and acknowledged them as their rulers. In A. D. 352 they rebelled, and in A. D. 366 they defeated the Japanese and killed their general. During the next two centuries, however, they appear to have been completely subjugated; for an educated Japanese informs me that as early as A. D. 655, the Japanese sovereign then reigning established a kind of government over the Ainos in Yesso, which was located near Siribets, a volcano on the north shore of Volcano Bay. In A. D. 1186, Yoritomo usurped the ruling power in Nippon, and becoming jealous of his brother Yosi Tsunai, had him put to death, according to history, at a headland on the east coast, now called Shendai. But according to tradition, Yosi Tsunai escaped to Yesso, and treating the Ainos here with the greatest kindness, was deified by them and is now their chief hero.

Although the Ainos had long been conquered by the Japanese, some of them yet lived on Nippon till about two hundred years ago, when they were all banished to Yesso. The same educated Japanese informs me that up to a short time ago, the ruins of a rude fortification—probably made by the Ainos—was to be seen at Nambu Point, the most north-eastern part of Nippon; and that similar ruins are reported to still exist among the mountains in the northern parts of that island. In Yesso, some ruins of a rude kind are reported at Saru, a village on the south coast, in the longitude of Cape Yesan at the entrance of Tsugar Strait; and—as the Aino interpreter previously said—the chief descendant of the old Aino kings, (and therefore their chief prince), is now living at that place, and claims to possess some of the presents made by Yosi Tsunai to his ancestors.

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* This is the manner in which the Japanese women fold their dresses. The Japanese men fold theirs from left to right.

In their abundance of hair, in their eyelids, which are horizontal and open widely, and in the full development of their chests, these people differ totally from the Chinese, the Japanese, and the Coreans on the south, and at least the Manchus and Mongols on the west; but in these same characters they call to mind the bearded peasants in Russia of the Slavonian branch of the Aryan family.

Are they, therefore, an extreme branch of the North Turanian family, or, as is more probable, in the same manner that the Indo-European races migrated from the high plateau of Central Asia to the west, and the Persians and Indians to the south, did another part of that same family pass on to the east until they finally reached the islands now forming the Empire of Japan; and do their living representatives now appear before us in the persons of this isolated and ancient people, the Ainos?

Dr. J. Wyman gave a general account of the results of his examination of the animals discovered in the shell heaps of New England. No remains of man had been found, with the exception of a single bone from the great toe, discovered at Cotuit Port; an equal absence of human remains marks similar mounds in Denmark. In the shell heaps of New England over fifty species of animals had been discovered, most of which were edible. Dr. Wyman had distinguished bones of the elk, moose, caribou, deer, bear, wolf, dog, fox, cat, otter, mink, sable, skunk, seal, beaver and woodchuck; seven kinds of birds, including the great auk and wild turkey, now unknown in this region; three species of fish, beside snails and bivalve shells.

Among vertebrates, the bones of the deer and of birds outnumber all the rest; as bones of dogs were found under the same circumstances as those of other mammals — the shafts broken — it is probable that dog flesh was used as an article of diet. In the remains of birds the shafts were always whole, but the ends had disappeared. Steenstrup, who had observed the same thing in Denmark, suspected that the bones had been mutilated by animals; upon experiment, he found that dogs eat the ends of the bones of birds and reject the shafts. Most of the snails were minute and only incidentally present.

The President announced that the Society was about to resume its former plan of giving public lectures on Natural History. The first series would consist of a course of six lectures on Mollusca, by Mr. E. S. Morse, the Curator of Conchology. The lectures would be given on successive Saturdays at 3, P. M., commencing December 7. Owing to the small size of the lecture room a regulation price of one dollar for the course would be charged.

Section of Microscopy. December 11, 1867.

The Curator in the chair. Seven members present.

The following paper was read: —

NOBERT'S TEST. BY CHARLES STODDER.

Most microscopists know the value of "Nobert's test" for ascertaining the resolving power of objectives. Some physicists have assumed that, owing to the properties of light, when lines approach within a certain distance of each other it is impossible to see them separately; and that consequently there is a limit to the power of the microscope in this direction, and when that power is attained, further efforts at improvement are useless. This limit has been fixed at different distances by different authorities, and by the same authors at different times, according as the microscope has been improved, and lines of increasing fineness have been seen.

Dr. Carpenter, in the first edition (1856) of the "Microscope and its Revelations," says: "even the $\frac{1}{12}$ inch (objective) will probably not enable any band to be distinctly resolved, whose lines are closer than $\frac{1}{7000}$ of a Paris line, or $\frac{1}{79000}$ of an English inch: at present, therefore, the existence of separate lines of a narrower interval than this, is a matter of faith rather than of sight; but there can be no doubt that the lines do exist; and the resolution of them would evince the extraordinary superiority of any objective, or of any system of illumination, which should enable them to be distinguished." In the second edition, 1859, he substituted $\frac{1}{85000}$ for $\frac{1}{79000}$ and adds: "There is good reason to believe that the limit of perfection in the objective has now been nearly reached, since every thing which seems theoretically possible has been actually accomplished." In the third edition, (1862) the figures are again changed to $\frac{1}{84000}$.

Messrs. Harrison and Solitt (Micr. Journ., Vol. II, p. 61, 1864) claimed that they had resolved the striæ on *Amphipleura pellucida*, 120,000 to 130,000 to the inch; and Mr. Solitt (Micr. Journ., VIII, p. 51, 1857) expressed the opinion that lines 175,000 to an inch might with proper means be seen. Here is a discrepancy important to be settled if possible. In order to do that, Messrs. Sullivant and Wormley (Amer. Journ. Sc., Jan., 1861) made a careful examination of Nobert's plate of thirty bands, from $\frac{1}{1000}$ to $\frac{1}{8000}$ of a Paris line. They used a Tolles's $\frac{1}{30}$ objective of 160° ang. aper., "an objective of rare excellence in all respects," "besides $\frac{1}{12}$ and $\frac{1}{16}$ of other eminent opticians, both English and American." They were enabled to obtain an amplification as high as 6000 diameters. "The true lines of the 30th band $\frac{1}{90070}$ we are unable to see with any degree of certainty." They conclude "that the lines on Nobert's test plate, closer together than about the $\frac{1}{87000}$ of an inch, cannot be separated by the modern objective." This appears to have been the most thorough examination of the test-plate of which we have any account. Notwithstanding that Sullivant and Wormley's paper was republished in London, and that the London opticians have been making higher power objectives since that time than they had ever made before, no response has been made by Harrison and Solitt, or any others, to their conclusion. The only information we have as to what has been done by European observers is a report (Quart. Journ. Micr. Soc., Jan., 1866) by Max Schultz of some trials on a test-plate. The highest set which he has been able to define with central illumination is the 9th (= $\frac{1}{56000}$ inch) which is resolved by Hartnach's immersion system No. 10, and by Merz's immersion system $\frac{1}{24}$. With oblique illumination he has not been able with any combination to get beyond the 15th band (=$\frac{1}{90070}$ inch). He considers the most difficult specimens of *Pleurosigma angulatum* to be about equal to the 8th or 9th bands of Nobert's lines, and the larger instances to correspond with the 7th.

The present year, Dr. Woodward, of Washington, D. C., resolved the 29th and 30th bands, $\frac{1}{90074}$, with Powell and Lealand's $\frac{1}{50}$, $\frac{1}{25}$, Hartnach's No. 10 immersion, and Wales's $\frac{1}{8}$ with amplifier; Powell and Lealand's $\frac{1}{25}$ perhaps the best, but all very nearly alike (Quart. Journ. Micr. Soc., Oct., 1867, p. 254).

In 1864 Mr. R. C. Greenleaf resolved the highest band on his diffraction plate—the same number of lines as the highest of Sullivant and Wormley's $\frac{1}{90070}$—with a Tolles's $\frac{1}{5}$. There may be, perhaps, some question as to this, but the next year he unquestionably saw the lines clearly and unmistakably with a Tolles's $\frac{1}{12}$. Thus accomplishing with a $\frac{1}{12}$ what had—so far as appears by the records—up to that time never been done, with any instrument of any power then made, and which has not been exceeded by any made since, until within a few weeks.

Mr. R. C. Greenleaf and myself have been trying a test plate of nineteen bands, the same as the one used by Schultz, with the following results:—

				Corresponding to band of the plate used by Sullivant and Wormley.
1.	$\frac{1}{1000}$ of a Paris line	$= \frac{1}{11240}$	Eng. in.	1st.
2.	$\frac{1}{1500}$ "	$= \frac{1}{16860}$	"	
3.	$\frac{1}{2000}$ "	$= \frac{1}{22480}$	"	
7.	$\frac{1}{4000}$ "	$= \frac{1}{44960}$	"	
9.	$\frac{1}{5000}$ "	$\frac{1}{56200}$	"	15th.
11.	$\frac{1}{6000}$ "	$= \frac{1}{67622}$	"	20th.
13.	$\frac{1}{7000}$ "	$= \frac{1}{78737}$	"	25th.
15.	$\frac{1}{8000}$ "	$= \frac{1}{90074}$	"	30th.
16.	$\frac{1}{8500}$ "	$= \frac{1}{96234}$	"	
17.	$\frac{1}{9000}$ "	$= \frac{1}{101434}$	"	
18.	$\frac{1}{9500}$ "	$= \frac{1}{107167}$	"	
19.	$\frac{1}{10000}$ "	$= \frac{1}{112660}$	"	

With oblique kerosene or gas light, condensed only by the concave mirror, the bands have been resolved as follows:—

Objectives.	Eye-piece.	Diameters.	Band resolved.
Wales, $\frac{1}{5}$ ang. aper. 140°	A	475	8th.
" " (by daylight)	B		11th.
Hartnach's immersion, No. 10, ang. aper. 155° to 160°	B	1062	10th.
Tolles's immersion, $\frac{1}{10}$, ang. aper. 170°	B		15th.
Tolles's immersion, $\frac{1}{6}$, ang. aper. 170°. By R. C. Greenleaf	B	550	19th.
Hartnach's No. 10=$\frac{1}{14}$, ang. aper. 155° to 160°. By R. C. Greenleaf	B	1150	15th.

December 18, 1867.

The President in the chair. Forty-five members present.

The following paper was read :—

QUERIES ON THE RED SANDSTONE OF VERMONT AND ITS RELATIONS. BY THE REV. JOHN B. PERRY, OF THE MUSEUM OF COMPARATIVE ZOÖLOGY, AT HARVARD COLLEGE, CAMBRIDGE.

The remarks made upon the Red Sandstone of Vermont, at various scientific meetings, and the theories expressed, or implied in regard to it, in journals of science, in text-books, and the like, are very dissimilar. Often, indeed, they are so utterly different in their character and bearing, as to be entirely irreconcilable with each other.

We are, therefore, naturally led to inquire whether these representations be correct ? That they are not all exact transcripts of things as they exist in nature, is evident from their diversity. What, then, is the right view of these strata, on which geologists have been, for a long time, so much divided ?

Presuming that the rocky beds themselves, respecting which there have been such differences of opinion, may have a story to tell, their own peculiar version to give, of their actual position and relations, we shall certainly do well to put them on the stand, if we have not already done so, and apply to them the most crucial tests, before we attempt to come to a definite conclusion, or to express any final judgment, on the points involved.

Let us, then, take a brief survey of this formation, raise a few queries in regard to it, as it is in itself and in its various relations, and try to answer them by an appeal to facts.

I. In the first place, what is the Red Sandstone of Vermont?

The late Dr. Emmons, long ago, described it as Potsdam Sandstone; and he ever after maintained, in regard to it, substantially the same opinion. In most geological reports, however, and in various other publications, in which it is mentioned, the rock under consideration is spoken of as belonging to the Medina formation of the New York geologists. Indeed, it has been quite generally so regarded, or rather it was almost universally thus viewed, up to a very recent day.

Without dwelling upon the various opinions that have prevailed on the subject, it may be said that the formation before us for study is a belt, or narrow band, of sandstone; that in color it is red, or reddish, though often gray, and sometimes creamy; that it has, especially in its upper parts, many calcareous beds; that, in a few instances, it is somewhat slaty in its structure; that it lies in the lower portion of the Champlain slope of Vermont, and dips gently to the east. In all localities it has been much eroded, what remains seeming to be only a small fragment of the original formation; at various points, indeed, it has been very largely cut away; while, in not a few cases, the beds have been, to all appearances, entirely removed. For these reasons, and on other accounts, it may be well likened to a reddish or cream-colored ribbon, stretched along the western limits of the State, almost every where gnawed, its edges being in most places deeply eroded and indented; while we find constant evidence that it has been in its whole length terribly eaten into, and in parts altogether worn away.

As early as the year 1847, perhaps it was somewhat earlier, Prof. Zadock Thompson discovered fragments of trilobites in a portion of the band, situated in the township of Highgate. Desiring to secure all the light he could on the subject, he furnished several Palæontologists with specimens of the fossils. These, however, failed to attract much attention; in fact, they remained for the most part unnoticed; thus the real age of the rock being still left, if not undetermined, at least to a great extent unrecognized, it continued to be generally regarded as Medina Sandstone.

This locality was often visited by Dr. G. M. Hall, of Swanton, and myself, all along from 1855 to '60, and many specimens of the Sandstone, containing the remains of two or three species of fossils, were from time to time collected by us. Early in the summer of 1861, E. Billings, Esq., of Montreal, while making explorations along the Provincial line, called upon me. On my showing him several glabellæ of the fossil trilobites, he at once remarked, they are *Conocephalites*, and the rock must be Potsdam Sandstone.

Waiving further reference to this matter, and without stopping to mention the different individuals,* who have engaged with pains-taking and praise-worthy zeal in the study of this formation, either at an earlier or a more recent day, I may simply add, that since 1861 the rock has come to be very generally, if not universally, recognized by geologists as belonging to the horizon of the Potsdam Sandstone. And that this determination is correct, there can now, I think, be no reasonable doubt.

II. We may next ask, whether this Sandstone be succeeded, on the east, by newer formations that have been disguised, as to their age, by metamorphic action?

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* It gives me great pleasure to refer in particular to the late Dr. E. Emmons, to the late Professors C. B. Adams and Z. Thompson, to the late President Hitchcock and his associates in the geological survey of Vermont, to Sir William Logan and to E. Billings, Esq., of the Canada survey, and last, but by no means least, to Professor Jules Marcou, now of Paris, as gentlemen by whose labors I have been not a little assisted, in various ways, in my study of the rocks of western Vermont.

It was for a long time asserted, and I suppose the affirmation is still made, that this rock which lies along the western limits of the State dipping eastward, underlies more recent formations on the east, and is immediately succeeded by them, as we pass in that direction; that these are probably of Silurian * and Devonian age, and follow the Sandstone in regular gradation; that having been subjected to intense heat, or having undergone changes through some other such agency, they have been greatly transformed; in short, that all the so-called Taconic rocks as described by Dr. Emmons, and after him by Professors Adams and Thompson, are later than the Red Sandstone, and have been so metamorphosed in structure, and obscured by the obliteration of fossils, as to be in most cases recognized only with extreme difficulty, if at all, in their true character.

In reference to these points it may be said generally, that the positions assumed do not seem to be sustained by facts. It is hardly necessary to remark, that the rocks referred to as lying directly to the east, do not ordinarily exhibit any such marks of metamorphism as the theory implies. And I need not now linger to state in detail, that more careful search has shown that some beds of the Taconic rocks are not a little fossiliferous. The first prominent fact, then, to which I would particularly refer is this: the Red Sandstone does not run under the formations which usually lie next to it on the east, as the dip might at first suggest. It simply rests on them in all the localities at which I have been able to find the exposed junction of the two rocks. Instead of passing under, the Sandstone often abuts against, these so-called newer formations, and sometimes apparently as if it had been shoved upon them, or they forced against it. That this is so may be seen in Swanton—to mention no other places—where, at several points, the Potsdam band has been entirely cut through, and large portions of it have been removed.† Exposures are thus afforded by the excavated gullies and valleys, which extend easterly and westerly, giving a view of the underlying rocks, as they occasionally crop out, as well as of the overlying sandstone, which flanks these ravines on the north and the south. In these cases, cliffs composed of the Red Sandstone merely repose on, or occasionally lie as if they had been thrust against, the formations which succeed on the east; while, in no locality, have I been able to find them running, or any evidence that they actually proceed, under the so-called more recent masses.

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* They were considered Upper Silurian, etc., when the Red Sandstone was regarded as Medina; now, perhaps, they would be viewed by some as Lower Silurian, and so on.

† There is needed, and it was my intention to give, at least one sectional diagram, illustrative and confirmatory of each main stratigraphic position advanced in this paper. It is hoped, however, that the matter will be plain, beyond mistake, even without a single diagram.

But more than this: the Red Sandstone, in several instances, extends over almost the entire, if not over the whole, width of the Taconic series of Dr. Emmons. This superposition is well exhibited in the counties of Addison and Chittenden. The Potsdam formation beginning in Charlotte and Ferrisburgh on the west, stretches across the country through parts of Hinesburgh and Monkton to Starksborough on the east, overlying nearly, if not quite, all the so-called Taconic rocks, which have been described as Silurian and perhaps Devonian beds, or as even later ones, metamorphosed. The latter and underlying strata are, for the most part, covered by this widely extending portion of the Red Sandstone; at many points, however, they so crop out, as clearly to reveal their true character; and they may be readily recognized by a practised eye. Something very similar is also observable in Franklin County. Taking our stand a little to the east of Highgate Springs, we find ourselves on the western limits of the sandstone.* Passing several miles eastward into the township of Franklin, we meet with patches of, the same Red Sandstone, overlying some of the most easterly portions of the Taconic range. I may likewise add that, in a hasty examination, made a few years ago, of the rocks in Canada just north of the last-mentioned locality, I found similar indications of a like superposition of the Red Sandstone.

Perhaps, however, some may be disposed to urge, by way of obviating the force of these facts, that there has been an inversion, or an overturn, of all these rocky beds; that thus the Potsdam formation, though really older than the Taconic strata, actually lies above them; that consequently the latter are, after all, only later rocks in a metamorphic state. If appeal be made to local overturns, I reply that, so far as I can judge, these are utterly insufficient to clear up the difficulties involved; for the sandstone and the adjacent rocks sustain to each other substantially the same relations, through the entire length of the State. Then the assumption of partial or local overturns is altogether inadequate to account for the position of the rocks at various localities, such as those already cited, and especially those between Charlotte and Starksborough. A cursory examination in the field ought to render this plain; should it not, it is thought that a more thorough one cannot fail to do so. If, on the other hand, appeal be made to a general overturn, comprising the main formations in western Vermont, it is natural and right to demand the proof. The *onus probandi* surely rests on the assertor. Now of any such inversion I have been unable, after years of search and of repeated examinations of the rocks from one extremity of the State to the other, to discover the slightest evidence or the faintest trace.* That there has not probably been an inversion of a general character, may be also seen, at various specific points, in distant and widely separated portions of the range in question. On the north-west side of Snake Mountain, in the township of Addison, the base of the sandstone is found so resting on the underlying slate, as to show that the present is substantially its original position. Along the line of junction there is a conglomerate—a mingling of the two formations—of such a kind and in such a condition, as clearly to prove that the upper beds were deposited above the lower, and very nearly as they now lie. Similar evidence will reveal itself to the close observer, at many other localities where the junction of the two rocks is visible,—at Lone Rock Point in Burlington, at Mallet's Bay in Colchester, as well as elsewhere. And then it may be said, that the sandstone generally is too little dislocated and broken, to allow us to infer any such inversion of the strata. To this should be added another significant fact: layers of sandstone containing impressions of raindrops, are found at various points, in their normal position, thus indicating almost anything rather than an overturn—in fact, its very opposite.

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*A few isolated beds of sandstone are found even further west than the Springs, along the shore of the lake, especially between Ship-Yard Bay and the Wharf. Some of them are finely folded. One of the best views of the folds is from the water.

Such being the case, the theory of metamorphism, so far as it is invoked to prove that the Taconic rocks of Vermont are later formations under disguise, seems to fall to the ground. This, of course, involves no denial of igneous agency, where there is evidence of its occurrence; in many cases, indeed, metamorphism is an undoubted fact; and it should be freely granted, that portions of the Calciferous Sandrock actually overlie parts of the Potsdam formation; but these excepted points, though a seeming admission, are of such a kind as to have no direct reference to the question in hand. Facts, therefore, so far as I have been able to find them, having a bearing on the subject, decidedly testify that the Red Sandstone does not extend under metamorphic formations cropping out along its eastern limits.

III. Again, let us inquire whether the sedimentary beds which underlie the Red Sandstone be an extension of the Potsdam formation downward.

The gray siliceous rocks at Potsdam, New York, were at first, by the one who originally described them, and have been ever since by many, regarded as the lowest portion of the vast accumulation of sedimentary strata. When, therefore, it became certain that the Red Sandstone of Vermont must be referred to the same horizon, it was very soon assumed that the fossil-bearing slates which underlie this formation must be regarded as a downward extension of the Potsdam Sandstone. Whether this assumption be correct or not, is to be determined by the import of the latter term. The word "Potsdam," in the earliest geological sense given to it, and as properly understood, primarily refers to the just mentioned sedimentary rocks in the township of Potsdam, and therefore, of course, includes whatever belongs to the said group of strata at that place. It also applies, by legitimate extension, to all rocky beds elsewhere found, of the same specific life-period. Accordingly, to belong to this series of deposits, a formation must either exactly answer in age to the beds at the typical locality in Potsdam, or else be a conformable extension, upward or downward, of synchronous rocks—that is, of rocks identical with them in the time of their deposition.

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* I may even go further and add, that having examined this range of rocks, at not a few different points, between Quebec and North Carolina, I have thus far failed to find any satisfactory indications of a general overturn.

How is it, now, with the sedimentary strata before us; what is their relative position? In the first place, the slates underlying the Red Sandstone of Vermont do not conform with it in dip. It is true that this want of agreement in the inclination of the beds is not great; still it is a clear instance of non-conformity, amply sufficient to indicate difference in age between the lower and the upper rocks. The variation referred to may be seen at Snake Mountain, in Addison County; in Charlotte, Shelburn, Burlington and Colchester in Chittenden County; also in St. Albans, Swanton, and Highgate in Franklin County, as well as in other places.

Again, there is a lack of conformity in the strike of the sandstone and of the underlying slates. This fact may be observed at the several localities just mentioned. It is especially apparent to a person surveying the whole range, as it stretches from one end of the Champlain valley to the other. A glance at the representation given on the Geological Map, published in the "Final Report" on the Geology of the State, will enable us, in case we make due allowance for differences in names, to estimate this discordance in its true bearing. Starting from Whitehall, New York, and passing down the valley of the lake, we see that the trend of the sandstone from west of south to east of north, is clearly greater than that of the subjacent formations. Indeed, its western edge passes obliquely across the Black Slates (called, on the map, "Utica" and "Hudson River") and the Georgia Slates, as may be well observed in the field, at various points along the line of strike throughout the range.

Once again, it should be remarked that there is a lack of conformty in the organic remains. The fossils which I have found in the two underlying masses of rock are as follows: (1.) in the Black or Swanton Slate, several species of *Graptolites*, *Atops trilineatus* (Emm.), and fragments of one, or perhaps of two, closely allied species as yet undescribed; (2.) in the Georgia Slate, one, if not two, undescribed species of *Chondrites*, *Palæophycus incipiens* (B.), and *P. congregatus* (B.), *Obolella cingulata* (B.), an undescribed species of *Orthis*, *Orthisina festinata* (B.), *Camerella antiquata* (B.), *Olenellus Thompsoni* (H.), *O. Vermontana* (H.), and *Conocephalites Teucer* (B.), with one or two other species of trilobites, probably as yet undescribed.* On the other hand, I have collected in the Potsdam Sandstone several species of described and undescribed Fucoids (*Palæophycus*), *Scolithus linearis* (H.), one or two species of *Lingula*, the remains of several other *Brachiopods* as yet undescribed, fragments of *Crinoidal* stems, also *Conocephalites Adamsi* (B.), and *C. Vulcanus* (B.). To these might be added two or three other species, hitherto discovered in these Vermont beds, and already described, with which I have thus far failed to meet. Now it is observable, and worthy of remark, that the several fossils just enumerated, as occurring in these two main groups—in short, that all the organic remains thus far brought to light in these strata—are specifically distinct. It is, in fact, possible, if I mistake not, to go even further and say, that no species is yet known to have been discovered, either in Vermont or elsewhere, common to the two systems of rocks; that thus, so far as we are aware, the lower series and the higher are respectively characterized by distinctive fossils, each by those peculiar to itself;† and, therefore, that we fail to find any evi-

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*The latter crustaceans I discovered, not long ago, in a mass of slaty limestone, apparently imbedded in Georgia Slate; both the limestone and the slate are fossilferous; but I have, up to the present, failed to find time, either to examine the mass as I desire, or to study the few specimens which I collected.

†As an aid to the eye, and since there will be occasion to refer to these organic remains again, it may be well to present them in a tabular form. Omitting the Lower Taconic, and reading from below upward, we have:

II. Potsdam Sandstone.		Conocephalites Vulcanus (B.). “ Adamsi (B.). Several species of Brachiopods undescribed. Lingula, probably two species. Scolithus linearis (H.). Crinoids. Fucoids, described and undescribed.
I.	Georgia Slate.	Articulates, undescribed, probably two species. Conocephalites Teucer (B.). Olenellus Vermontana (H.). “ Thompsoni (H.). Camerella antiquata (B.). Orthisina festinata (B.). Orthis, undescribed. Obolella cingulata (B.). Palæophycus congregatus (B.). “ incipiens (B.). Chondrites, one or two species undescribed.
	Swanton Slate.	One or two undescribed species of Articulates. Atops trilineatus (Em.). Graptolithus, several species.

dence in the organic remains, that these groups of strata belong to the same specific life-period.

It should accordingly seem, from this three-fold lack of conformity, that the beds underlying the Red Sandstone are distinct from it. Indeed, the facts brought forward make it appear that the lower rocks cannot be, with any propriety, either referred to the formation, or regarded as belonging to the period called Potsdam.

IV. What relation, then, we may now ask, does the Red Sandstone sustain to the underlying formations?

The true answer to this query must depend upon the determination of the age of the inferior rocks in question. These, and especially portions of the formation sometimes called Black Slate, were long and generally, though by no means universally, regarded as Utica Slate and Lorraine Shale. They should be divided, as is most probable, into two parts, and may be locally designated as the Swanton Series and the Georgia Series. The western, or Swanton, portion is usually very dark, or black, and hence the name Black Slate, by which it is often known; that next to it on the east, or the Georgia range, is for the most part brown; while both groups contain interstratified layers of sandstone and limestone. The fact that beds of brown sandstone occur in connection with the slate, sometimes clearly interstratified with it, has led many inadvertently to refer them—indeed, often to consider the whole of these inferior formations as belonging—to the Potsdam series of rocks, even in localities in which the lower and the upper groups may be seen to be unconformable, and therefore, as has been already shown, clearly distinct from each other.

That these lower formations are not of so late an age as the Utica Slate and the Lorraine Shale is apparent, both from what has been said of the Red Sandstone which overlies them, and from other considerations. In some cases, the Black or Swanton Slate may be seen beneath the Potsdam Sandstone, not only along its western flank, but also at the very edge of its eastern limits. After long searching, I was at last so fortunate as to find the two rocks thus situated, and in immediate conjunction. This was on the easterly border of the sandstone, at Shelburn Falls, where, some years ago (in the summer of 1860), an excavation was made in the channel of the La Platte River. Since that time, I have observed substantially the same thing at many other points. So the Georgia Slate may be traced beneath the Potsdam Sandstone with equal clearness, and shown to underlie it, in its extreme extension eastward in Swanton; while the two rocks may be seen to sustain virtually the same relations in St. Albans, in Highgate, and in fact in not a few other localities in western Vermont. These facts, with their concomitants, it is thought, entirely meet and set aside the supposition still sometimes made, that the underlying slates may after all be Utica, the Potsdam beds having been pushed westward, and thus made to overlap them in their greatest extension to the east. That, perhaps, the sandstone was moved laterally, at an early day,—that there are, in places, what are called slickensides,—that there may be occasional masses of the Utica along the western margin of the Potsdam,—no one, though he closely question the points, need altogether to deny; for these, in part at least, are facts: but, at the same time, there is abundant evidence that the lateral movement of the sandstone over the slate was not extensive; indeed, there is incontestible proof, which cannot be here given, that in many instances it could not have exceeded a few inches at the most; that thus it was by no means equal to almost the entire width of the formation; that, therefore, it was wholly insufficient to make the easterly limits of the two systems of rocks, in different places, nearly conterminous.

While, then, these subjacent beds cannot be properly regarded as Utica Slate or Lorraine Shale, because of their stratigraphical position beneath the Red Sandstone; while their nonconformity with it also indicates, beyond all controversy, that they are different from and older than the Potsdam formation,—we should still remember that their included organic remains have important testimony to bear—testimony to which I have as yet made no direct reference. It is to this effect: these organisms show that the underlying slates clearly answer to the Primordial Zone of Barrande. In a word, the fossils found in these lower rocks—in the Swanton and Georgia Slates—of the counties of Addison, Chittenden and Franklin, and already referred to, are, as I presume no one now denies, unmistakably of a primordial type.

So is it, as we may see when we look at the matter broadly, with the fossils of the overlying Red Sandstone. They most certainly belong—not in a narrow, not again in the widest, but in a wide view of the subject—to what is called the Primordial Zone of Life. By this is meant—not that they are the remains of the very first living creatures that appeared on the globe (for the Potsdam, as we have seen, is not the oldest fossiliferous formation); not merely, on the other hand, that they are found in the great Palæozoic circle of rocks, but—that they are a part of the first grand type of life, so far as we are yet able to determine it. They are, however, later—a trifle later in the geologic sense of the term—than the organic remains of the subjacent beds of slate. They are later, I say, and yet, as I grant with equal readiness, they are closely allied. But in freely admitting that they are nearly related in organization, I would not neglect emphatically to add, that they are by no means identical. While they are in some cases generically the same, they are always, so far as we yet know, specifically different. And still, between some of the species, there are intimate resemblances. The closeness of this relationship is manifestly evident at a glance, on comparing *Conocephalites Teucer* of the Georgia Slate with *Conocephalites Adamsi* and *C. Vulcanus* of the Potsdam (to say nothing of *C. arenosus* and *C. minutus*, found just beyond the limits of the State)—species which, while distinct, are very closely akin. Should future discoveries indicate the existence of several species common to the beds under consideration, they will only confirm and strengthen our apprehension of the truth, which we already recognize. And so the general, to say no more of a specific or of a generic alliance, is seen to be strikingly intimate, when looked at in a typical point of view, from a wide comparison of the fossils of the two series of rocks now occupying our attention.

This being the state of the case, it must seem clear, that while the underlying and the overlying beds are discordant in dip, in strike, and included fossil remains, they are yet nearly related; that they both should be regarded, when contemplated broadly, as belonging to one and the same great zone of living existence; that the Red Sandstone accordingly claims recognition, and must of good right be recognized, as an upper division of the Taconic, or Primordial System of rocks; nay more, that it follows the inferior groups, after a short break in time, and a slight interruption in the organic succession, and seems to cap them with the more mature forms of the same grand type of life.

V. We may accordingly ask, as a final question, whether the Red Sandstone can be properly referred to the Lower Silurian System of rocks?

The Potsdam formation has been almost universally counted as the base of the Champlain, or Lower Silurian, beds of New York. And this determination of the mass under examination was very natural, especially at the time and place at which it was originally made; for no fossil-bearing strata were then known to be older; while in Potsdam, the typical locality, the formation in question rests directly upon rocks usually called igneous. It is moreover succeeded, at many points, by the Calciferous Sandrock, and often by other and later members of the Champlain series.

It seems to be a fact, however, that the Potsdam Sandstone and the Calciferous Sandrock are stratigraphically unconformable. There is a lack of conformity in dip, in strike, and, as is clear in many cases, in the order of succession. In other words, we often find evidence that the latter division of rocks did not, at least in all instances, immediately follow the former in the order of time. This discordance may be seen in part at Chazy, New York, where the two formations crop out in close proximity, and near their junction, along the western margin of the Calciferous. Their relations may be in some respects well observed likewise at Whitehall, New York; so in West Haven, an adjacent township of Vermont; also near the village of Orwell, in the latter State, as remarked by Dr. Emmons.

These groups of rocks, moreover, are seen to be unconformable, when looked at palæontologically. Indeed, there is an almost total break, in the sequence of life, between the two formations. If I mistake not, no species in Vermont, and only one anywhere else, is yet known to have passed upward from the Potsdam into the Calciferous period. The species referred to, which was described by Mr. Billings, is the *Pleurotomaria Canadensis*. It is possible, however, if not probable, as I understand the matter, that even this species is not of so early an age as supposed; that the lowest bed in which it has been found, may be ultimately referred to the base of the Calciferous; and thus, perhaps, that it did not, after all, make its appearance until after the Potsdam epoch. But, be this as it may, the interruption, all things considered, is clear beyond a question. Still this palæontological discordance alone, while it is in itself significant so far as it goes, is not enough; it is only negative. It will have greatly increased force, and be made to stand out in a more striking light, if it can be connected with other and positive testimony.

And there is additional evidence of a positive kind. It is, as may be remarked, to this effect; a different and an advanced zone of life seems to commence with this higher formation. The characteristic primordial forms disappear almost entirely, if not altogether, with the Potsdam; while a new, and what should be perhaps called the second, great chronological type of existence makes its appearance, as it probably has its dawn, in the Calciferous; and it is easily recognized in the fossil remains of this group of beds. Looked at under the relations of time, there is seen to be a marked difference between the two formations; chronologically speaking, the types of life are clearly not the same; indeed, their distinctive marks are widely unlike.* In case, then, I mistake not the evidence (and I really think I understand it), there is a divergence, if I may so express it, of a distinctive character. And this distinction between the two series of rocks is apparently coming to be more fully recognized every year, as their characteristic fossils are more carefully examined and minutely studied, withal more critically compared and thus better known, especially in the grand type-features by which they are respectively distinguished.

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* I am happy to be able to say, that the extensive and careful observations recently made by Professor Marcou, on the older sedimentary formations, in Vermont and elsewhere, tend to establish the primordial character of the Potsdam Sandstone. And this reminds me that I ought not to omit reference to the several publications of Mr. Marcou on these rocks, to the palæontological contributions of Mr. Billings, and to the incomparable papers of M. J. Barrande, *Sur la Faune Primordiale et le Système Taconique en Amerique*, as eminently deserving the study of all who would become acquainted with the literature and bearings of the "Taconic question."

These facts accordingly seem to indicate that the Potsdam Sandstone is not correctly described, and cannot be properly viewed, as the lowest, or as a lower, member of the second great group of fossiliferous strata; that, of good right, it should be regarded as the summit, or crowning portion, of the primordial series; and that thus the Calciferous formation both presents itself in nature, and in consequence imperatively claims recognition, as the base of the Champlain, or Lower Silurian, system of rocks. Such a division between the primordial life-period, and the great one that follows it, is certainly suggested by what is thus far known of the formations; and, if facts prove it to be what it appears, it ought surely to be acknowledged and adopted, both as tending to make our classification more simple and exact, and as helping to render the relations of these two extensive series of sedimentary beds—at once amongst themselves and to each other—more distinct and easy of comprehension.

Having thus cursorily surveyed the Red Sandstone of Vermont, as it is in itself and in its more general relations, I will close this paper with a brief synopsis of the two great systems of rocks which have been under review. Reading from below upward, we have: —

II. Champlain.
3. Upper: — Birdseye Limestone, Black River, and Trenton, Utica Slate, and Lorraine Shale.
2. Middle: — Chazy Limestone, in its several divisions.
1. Lower: — Calciferous Sandrock, in its several divisions.

I. Taconic.
3. Upper: — Potsdam Sandstone, in its several divisions.
2. Middle: — Black and Brown Slates, with Limestones and Sandstones.
1. Lower: — Talcose and Talcoid Slates, with Limestones and Quartzites (or Conglomerates).

The above is given, as the most satisfactory general view, that I have been able, up to this time, to get of these rocks, after a long study of them in the field. And it is presented, without details, and by no means as an *ultimatum*, but simply as an essay toward the solution of some of the manifold difficulties involved in one of the most intricate and perplexing sections of the Geologic Record; presented with diffidence, and still with unwavering confidence in the truth of nature; presented in the hope that new light may be elicited; that old errors, so far as they exist, may be discarded; and that thus a more consistent understanding of these formations may be at last secured.

In this summary, the terms "Taconic" and "Champlain" are used, not as implying any theory, but because they are familiar and local.

Inasmuch as they were introduced long ago, are simple, short, and convenient, as well as locally descriptive, also as commemorative of the honored dead, I see many good reasons for retaining, and no occasion for discarding them. We need local designations for the rocks of each typical, as well as for every geological, district.

Only such organisms are mentioned as have a bearing on the questions at issue; while no special reference is made in what has been presented to the fossil remains of kindred formations, lying beyond the limits of Vermont; for these, even when of different periods, have been often greatly intermixed, or perhaps all referred promiscuously to one geological age; and because little or no use could be made of them, in the determination of the points before us, without an accurate discrimination of the order of succession, and a thorough exhibition of the stratigraphic relations, of the beds in which they occur.

It has accordingly been the aim, in the remarks which have been made, both to clear away a vast mass of useless matter, and to lead to the recognition of a firm basis on which the geologist may take a secure stand, and thus be prepared for further and more minute examinations of the earlier fossil-bearing strata, as well of western Vermont, as of other regions. Consequently, the present essay, which is presented as a slight contribution in the form of a first-fruit offering, may be regarded as simply introductory to a series of papers, designed for some future occasion, on the sedimentary rocks, a synopsis of which has been given; a series of papers, in which it is proposed to set forth the various points of importance pertaining to each formation; in which it is the desire to embody a large amount of unused material that has been accumulating for years; and in which I hope to enter more fully into those critical details, always needful no less to a thorough and satisfactory understanding, than to an exhaustive presentation, of a subject at once so intricate, so replete with the charms of novelty, and so intensely fraught with the grandest interests, both scientific and practical.

Professor Agassiz expressed his pleasure at hearing this able discussion of the subject from one who had examined the localities with the greatest possible care and faithfulness. He reviewed the history of the Taconic system of Professor Emmons, and referred especially to the time when all American geologists, with the single exception of the author himself, believed the views advanced in that work to be utterly untenable. To the plausible argument of his opponents, Dr. Emmons could only answer that time would show the truth of his position, even should he himself not live to see it accepted. The renewed and successful solution of this question, Prof. Agassiz considered due to many persons, but most especially to the author of the valuable paper just read. Mr. Perry had personally collected the fossils, studied the rocks, and furnished all geologists with the materials used in the discussion of this topic.

Professor Agassiz stated that he had recently been reviewing the Siluroid fishes for the sake of illustrating the definitions he had long since presented for the different categories of structures among animals.

The Siluroids had always been considered a natural group ; placed, at first, in a single genus which was subsequently divided into two, they were next considered a family including several genera, and finally an order, embracing several groups termed families. Was there then no meaning in the terms genus, family, order? Professor Agassiz urged strongly that the application of these terms should be uniform, since a genus really remains a genus no matter how numerous its subdivisions. He believed that *orders* were founded upon degrees of complication of structure, and *families* upon the forms of animals. Gill, finding that Bleeker had divided the group of Siluroids into several families, raised it one grade higher and called it the order of Nematognathi—a name implying a structural feature of no ordinal value whatever. Professor Agassiz claimed that the group was an order of Ganoid fishes which should be placed between the sturgeons and garpikes ; they had one striking feature in the structure of the jaws, not only reptilian, but bird-like ; this was the power of sliding the palatine bone upon the sphenoid and thus thrusting the barbel forward. The brain greatly resembled that of a sturgeon. Four families were mentioned belonging to the order, the Goniodonts, the Loricariæ, the Callichthyoids and the Doradides ; their characteristic forms, arising from the peculiar development of the parts about the lateral line, were represented on the blackboard.

January 3, 1868.

The President in the chair. Forty-six members present.

The following gentlemen were elected Resident Members: Rev. Louis B. Schwartz, Dr. B. L. Delano and Messrs. George G. Lowell, Percival L. Everett, Joseph Pratt, Arthur

Rotch, William Thomas, Edward C. Pickering and James C. Merrill, Jr. of Boston, Dr. Herrmann Hagen of Cambridge, Dr. Edward R. Cogswell of Cambridgeport, Dr. Edward Gilchrist, U. S. N., of Chelsea, and Prof. J. D. Runkle of Brookline.

The following paper was read:—

THE STRUCTURE, FLIGHT AND HABITS OF THE DIFFERENT VARIETIES OF THE DOMESTICATED PIGEON. BY EDWARD DOUBLEDAY HARRIS OF CAMBRIDGE.

It is proposed in the following pages to notice in a very brief and cursory manner a few of the many varieties of domesticated pigeons known in this country and abroad, and at the same time to draw attention to their very peculiar and interesting habits.

For the sake of convenience in handling the subject. I will divide the different varieties of which I shall speak, into five groups—distinguished from each other by strongly defined and peculiar characteristics. They are:—

1. The Tumblers, which may be further subdivided into three groups, the common air tumbler, the so-called ground tumbler, and the roller.
2. The Fantails, perhaps, through the common white variety, better known than the others.
3. The Pouters.
4. The Carriers,—and
5. The so-called Toys, in great variety and which I shall further subdivide later.

Before introducing the several groups to your notice in anything more than this general manner—a few remarks respecting the colors common in the different varieties may not be amiss. The *cultivated* colors, if I may employ such a term, are five; all others are modifications or blendings of these. They are *black*, *blue*, *red*, *yellow* and *white*.

The black, in its perfection, is a perfect, intense black, equal to that of the crow. The blue is a light slate color, very fair examples being seen constantly in the case of our common street pigeons. In perfection there should be no white, and the wings should be barred with black. The red may be better described as a cinnamon, or more exactly as a deep bay. The yellow is a peculiar color—I can liken to it only the inside shell of the English almond, and, in fact, this color in the United States is commonly known among bird fanciers as *almond*. The two colors, red and yellow, as I have described them, are by no means common in ornithology, and if we accept Darwin's theory of the origin of all these varieties, it is difficult to see how they were produced in the first.

Passing to the first of the groups previously mentioned, the *tumblers*, we find here three classes as before enumerated. The air tumblers are of all the five colors, and of all possible conglomerations of those colors.

The shape is a prominent peculiarity. You will observe in the two specimens upon the table a marked difference; one is a common street pigeon, the other is a very beautiful specimen of the yellow, or almond tumbler. In this latter, the head is well set back, the breast prominent and broad, the eye small and bright, the beak short and fine, and the tail rather pointed than otherwise. The tumbler is distinguished, too, for its alertness and activity, but its striking peculiarity is shown in its flight. The perfect tumbler then rises to a great height, wheeling with great rapidity, and at intervals turning a complete somerset in the air. At such times the bird does not pause or drop in its flight; the head is suddenly thrown upwards and back, the wings held motionless and outstretched, and the body is twirled over, as it were on a pivot. The evolution in highly prized birds is repeated rapidly twice, thrice, or more times. I do not know of its parallel in the feathered tribe: it seems to proceed from pure exuberance of spirits, and to give as great a pleasure to the bird itself as to the wondering spectator. The attainment belongs solely to the tumbler, and so far as my own experience goes in watching the habits of these birds, extending over a period of ten years, I have never known a hybrid to manifest anything more than the feeblest attempt at a somerset.

The so-called ground tumbler, is simply a variety of the air tumbler. He never attains a high flight, being often incapable of reaching any considerable height, but contents himself with turning a succession of somersets in rising to or falling from the perch. All that I have ever seen are shaped more like the common street pigeon, and resemble the Indian birds rather than the European.

The rollers are very rare in this country. Several years ago an old sailor greatly amused me by stating that he had seen in India, a pigeon that rolled over on the ground like a cart wheel. I did not in the least credit the story, but soon after I received a box of pigeons from Calcutta, and among the number was a roller. The mate had unfortunately rolled through the ship's scuppers on the voyage and was lost. This bird, a female, was placed in my coop and reared quite a number of young ones until two years ago, when an accident deprived her of life. She was at first mated with a remarkably fine air tumbler. The young never tumbled or rolled. She was then sent to

Portland and mated with a ground tumbler there, but the progeny were no improvement upon the former. Her flight was that of an ordinary pigeon, but at intervals, always while upon the ground, she would throw herself over and with wings extended to serve as purchases, would literally roll upon the ground many feet at a time without stopping. When arrested by an opposing object or from sheer exhaustion, she would scramble to her feet, and as soon as breath returned start off upon the wing.

It is an interesting question whether this tumbling or rolling propensity, developed in a greater or less degree in the three varieties, is a natural or educated trait. It is certain that as many as nine out of ten of carefully bred young, tumble as soon as they attain strength and confidence in their flight, commencing with very cautious and slow attempts, but when proficient in the art, turning so rapidly that it requires a quick eye to analyze the movement. I have never known or heard of any means by which this peculiarity could be taught—nor can I imagine any way. Sometimes when a young beginner fails in his attempts to complete his somerset, the fancier plucks out one or two of the outer feathers on each side of the tail, and even cuts an inch or so off the length of the tail, thereby lessening the resistance to the air. And one fact worthy of notice is that the tail of the good tumbler is almost invariably rather pointed than spread in its form.

The second group, the Fantails, are, from their beautiful forms and spread tails, great favorites. The specimens here shown are all remarkable, the first, the common white variety, being of unusually fine carriage, and very perfect in its form. The second is completely black. This variety is highly prized and quite uncommon, and the specimen on the table is the finest I have ever seen. The third is exceedingly rare. It is of an almond color, slightly marked with white : a perfect almond fantail I have never seen.

The third group consists of the several varieties of Pouter. The individuals differ only in color, the leading characteristics being the same in all. I believe this to be the largest species we have. The specimen on the table is a young bird—eighteen months old, and not yet in his prime. I have heavier and larger ones in my collection, but none so purely and decidedly marked as this. In shape the Pouter is very tall and slender, the legs long and heavily feathered even to the toes, and the carriage remarkably upright. The striking peculiarity is in the throat. He has the power of wonderfully enlarging the crop with air. This faculty is not confined to the male although the power of the female in this respect is less.

The fancier is very arbitrary in his demands as to the marking of the Pouter. Whatever be the color—although the blue is properly the type of the race—the white marks determine the value of the specimen. There should be a crescent beneath the bill regularly defined in its form, and on the first joint of the wing a cluster of white feathers called the "rose pinion." The Pouter is one of the highest prized and most valuable varieties. The parent birds from which this specimen was reared, were valued at one hundred dollars by their owner.

The fourth group, the Carriers, and those allied, have perhaps as large a claim on our attention as any. The individual in the cage is borrowed for the occasion. I long since banished them from my collection, on account of their wild and untamable character. They are very tall, with immense length and power of wing, slender and tapering body, the beak and eye surrounded by a rough fleshy wattle, the size of which greatly adds to their value.

I apprehend that there is a very general misunderstanding as to the traits of this variety. They fly but in one direction when at large—always to their homes, and are, of course, useless so far as transmitting messages is concerned, except always in that direction. Their superior size and strength, as well as their peculiar build, so well adapted for rapid flight, are the only advantages they possess over any of the larger varieties when employed as messengers.

There are several other species, closely allied to the Carriers, but as they probably had a common origin, it is not necessary to name them here.

In the fifth group, for convenience, I have placed all the other varieties. I can mention only a few of the prominent ones, leaving the others perhaps for another occasion.

The Turbit deserves the first place. It is in Germany, I believe, the favorite bird. The combinations of colors are very curious ; I have here two specimens differing totally in color, and these are only two of many. The distinguishing marks are the frill or double row of reversed feathers on the breast, the cap or hood, the short, firm beak, and sprightly, upright carriage.

The Swallow is a beautiful and prized variety. The specimen in the cage is much more perfectly marked than the average. It is a shy, retiring bird in its disposition ; the very reverse of the Turbit. In color the body is always white, the top of head, entire wings and boots (which should be very heavy), either black, blue, red or yellow. The cap or hood, too, should never be missing.

The Ruff or Jacobin is a very beautiful variety. The one in the Society's collection is a very good specimen of the yellow.

The Trumpeter is a singular variety. It is booted, capped, and has a long, upright tuft of feathers at the root of the beak. This latter peculiarity is almost missing in the stuffed specimen owned by the Society. The Trumpeter derives his name from the peculiar hollow call, fancied by some to resemble the low notes of a trumpet.

Of the starlings, quakers, nuns, owls, magpies, beards, and a score of others, I have not at present time to speak, and will only call attention to the beautiful variety called the Snell.

The habits of the pigeon are very interesting, and but little known. At this season of the year, unless the coop is artificially warmed, they show but little inclination to breed. But two months later, the old pairs make up their winter's quarrels, and odd birds select their mates for the breeding season which is about to commence. Now the owner must exercise much watchfulness and care. Once mated there is seldom any trouble, or danger of hybrids. Young birds, if well mated at first, usually retain their mates for several years, but old birds whose mates have been often changed become careless and unfaithful, and should be kept isolated, if possible.

The pair will soon begin to collect straws and coarse sticks for a nest or take possession of an old one. Many birds do not build at all, but the females lay upon the floor in some quiet corner where they are undisturbed. For a day or two previous to the laying of the eggs, the cock bird drives the hen from place to place, giving her no rest except when upon the nest; actuated I suppose by some instinct or fear for the safety of the eggs. The first egg is laid late in the afternoon, and the second (for they lay but two) on the morning of the third day. Setting then begins in earnest. The female leaves the nest every morning at about nine o'clock, the male relieving her until three o'clock in the afternoon. At the end of the eighteenth day the young birds begin to break the shell and soon make their escape. They are entirely destitute of covering and very helpless. For the first day or two they receive no nourishment, after that for about ten days, the female feeds, at first wholly with a natural secretion of a pulpy consistency which she ejects from her own crop into the beak of the young. This secretion gradually diminishes in quantity and its place is supplied by grain, etc., which is swallowed by the old ones, and after it has become masticated and heated is fed out to the young. Pigeons never carry their grain to their nests in their beaks. It is always first swallowed. Very soon the male bird assumes the greater share in supplying food to the young, and often, after the exhaustion of the natural food of the female takes them under his sole charge. The young grow with wonderful rapidity, and if properly fed and brooded soon begin to feather; when about four weeks old the parent birds either eject them from the nest and lay again, or select some other spot leaving the young in quiet possession of their cradle, although still under the watchful eye of the male. Three broods are generally raised from March to August, when the annual change of feathers occurs, and generally breeding is stopped until spring. The common street pigeon, however, being more hardy, often raises six or seven broods in the year. The young are generally, but not always, male and female.

The diseases to which the domesticated varieties of pigeons are subject are not many. The only serious one is almost unknown to the street pigeon. It is a species of catarrh, brought on by one of three causes : cold and damp, high feeding, or "in and in breeding," the most fatal mistake pigeon breeders are guilty of. The disease runs like wild-fire through the collection. Young and old are alike attacked and perish almost inevitably. On one occasion, five years ago, in ten days' time, I lost over forty specimens out of a collection of one hundred. The street pigeon, picking up a precarious subsistence, and shifting always for himself, is never attacked with this scourge.

Mr. George L. Vose, of Paris, Me., read a communication on the flattened and distorted pebbles in the conglomerate, occurring near Rangely, in Maine.

He reviewed the different theories, accounting for their form and exhibited drawings and tracings taken from the stones themselves. He endeavored to show that the changes had taken place while the pebbles were hard and not necessarily, as urged by Dr. Hitchcock and son, while in a plastic condition. This was best shown by a tracing in which one pebble had been bent over another and exhibited lines of fracture converging toward the point of resistance with an abrupt depression of the central portion of the overlying pebble.

Mr. Theodore Lyman gave an account of the progress recently made in New England in raising edible fish.

Mr. Seth Green had discovered that the eggs of shad needed to be constantly washed by fresh water to insure hatching. Mr. Green had invented a box which would secure this condition when floated in a river. The box should be placed at such an angle that the water bubbling up through perforations in the bottom would keep the eggs within in constant motion. In this way a much larger proportion of fish could be brought to maturity than if the eggs and young fish were left a prey to all their natural enemies; at least ninety per cent. could be hatched by the artificial process, for in one experiment only three out of ten thousand were lost. The differences between the embyro of the shad and salmon were pointed out. In salmon the eggs need a temperature of from 45° to 55° and are hatched in from sixty-five to one hundred and twenty days, and then the yolk sac remains upon them for forty-five days longer. In shad the eggs require a temperature of 75°, are hatched in sixty hours and have a pendant yolk sac for only forty-five to sixty hours.

Mr. Alpheus Hyatt presented a copy of No. 5 of the Bulletin of the Museum of Comparative Zoölogy, published about a week since, but accidentally bearing no date of publication. In it he had attempted to group the numerous species of Ammonites into natural genera and families.

Section of Microscopy. January 8, 1868.

Mr. John Cummings in the chair. Ten members present.

The following paper was read: —

NOTE ON A POINT IN THE HABITS OF THE DIATOMACEÆ AND DESMIDIACEÆ. BY ARTHUR MEAD EDWARDS.

Although most writers on the subject are in the habit of stating that many of the genera of Diatomaceæ in the living state are free, or non-adherent to other larger algæ or submerged substances, yet always since I first began the study of the Protophytes, as is well known to my fellow-students with whom I have from time to time discussed the subject, I have held that all species are, at some period of their existence in an adherent or attached condition, growing upon, for the most part, aquatic vegetation of a larger size. I have also frequently expressed the opinion that the adherent condition of any species was but temporary and conditional; otherwise I could not see how the wide distribution of forms, such as *Cocconeis scutellum*, an extremely widely diffused marine species usually found attached to larger algæ, or *Tabellaria flocculosa*, an equally cosmopolitan fresh water species found almost invariably attached, was provided for, as no motile spores of any kind are known to exist in this family, although such may be the case.

At the outset of my studies of these extremely interesting organisms I naturally accepted the classification laid before me by the authorities on the subject, and referred the forms I found to one or the other of the divisions of free or attached genera, and, in fact, went so far as to construct and adopt terms expressing these two conditions. The adherent forms I grouped under the general head of Epiphytaceæ and the free under that of Eleutheraceæ. As my studies progressed, however, I was continually meeting with cases in which this arbitrary mode of division would not apply, and the natural conclusion come to was that the method was defective, as it did not agree with facts. At last I have thus to publish my conviction that such a division of the Diatomaceæ into free and attached genera does not exist in nature, and that most, if not all species are free at one period of their existence and attached at another. I have seen several species which are almost universally ranked as fixed species existing in a natural state free and possessed of motion which they never displayed in their attached condition. Although it is not my intention at the present time to go very deeply into this subject, yet I desire to record that I have noted the following instances of such occurrences among others of similar kind. *Gomphonema acuminatum* and a *Cocconema*, the species of which was not at the time determined, moved about in a vigorous manner when found naturally detached, and also when freed from their stipes by violence. Again, several years ago I made a gathering of *Schizonema cruciger*, a species which consists of siliceous frustules enclosed within tubes of membranous material growing upon other submerged matter, having its frustules free and swimming actively about upon the surface of the water without any signs of investing tubes, which, however, were found empty but standing erect and adherent at the bottom of the ditch inhabited by the *Schizonema*. I have noticed that bare stipes of an *Achnanthes*, without any pendent frustules, are by no means uncommon, and also *Gomphonema* stipes can be found in the same condition. In such cases, doubtless, the freed frustules might be found near by, and, in fact, I have in what may be called "free" gatherings, floating upon the surface of the water, observed *Cocconeis*, *Achnanthes*, and other forms which, at one time I was in the habit of classifying as Epiphytaceæ. Once I freed, by violence, *Schizonema Grevillei* and a *Synedra* which accompanied it, and they both moved about in a rather lively manner, although the motion of the *Schizonema* was much more vigorous than that of the *Synedra*. This was not remarkable, as the frustules of *Schizonema* and *Homœocladia* are well known to be freely moveable within their investing tubes, although I do not remember to have seen the fact of their activity without that enclosure recorded. The observance of these facts of the motion of the detached frustules of such well-known forms as *Schizonema*, *Gomphonema* and *Achnanthes*, calls up in the mind the question of the individuality of the Diatomaceæous frustule, and it is a point to which I would call the attention of students as one deserving and, in fact, calling for further and searching investigation. If the whole frond of a *Homœocladia* with its myriads of enclosed frustules is an individual, then is the usually free *Nitzschia*, a single frustule of which can not be morphologically distinguished from a single detached frustule of *Homœocladia*, also an individual? and is a *Navicula* an individual as well as the group of similar forms enclosed within the tube of a *Schizonema* or the gelatinous frond of a *Mastogloia*? Again is a *Cyclotella* an individual as well as the long chain of discs which go to make up the frond of a *Melosira* or *Podosira*? Upon this point I shall, hereafter, have more to say, merely begging the record of an observed fact bearing thereon by students of this extremely interesting, and, I am convinced, important branch of natural history.

I desire to place on record that I have seen at least two, apparently and generally acknowledged free species of Desmidiaceæ, attached to a submerged aquatic moss. One was a *Closterium*, species not determined, which was for a long time (as during the most of last summer the specimens were growing in one of my aquaria) attached pretty firmly, by means of a true stipes or stalk of no great length, to the leaves of the moss, and that so strongly that it required some considerable force to detach it. By rocking the covering glass upon the slide, upon which the specimen of moss was placed during observation by means of the microscope, the *Closterium* could be made to swing about from side to side upon its stipes without becoming detached. The other species, observed at the same time, was a *Micrasterias*, and this was fixed, generally in pairs, to the same moss, by its broadest side, or by both valves, so as to present a "front view" (as it is termed when speaking of Diatomaceæ), to the observer, thus presenting an analogy to the genus *Epithemia* of that family which occurs growing after the same manner; *Cocconeis*, on the contrary, is attached by means of the whole of one of the valves. The stipes of the *Closterium* was, of course, at the end of the frustule where the valve comes to a point, after the manner of a *Cocconema*, which genus *Closterium* resembles much in form. In neither of these cases do I designate the species, as that I deem hardly of importance, the mere fact of Desmidiaceæ being found under such conditions being the important one. At the same time, it is as well to mention that these species were thus found during the month of August, or in the midst of the summer, the same forms having been observed free and moveable in the early part of the spring.

I have now to place upon record, my opinion that the Desmidiaceæ are governed by very much the same law as applies to their apparently near allies the Diatomaceæ; that is to say, that they are all at some period of their existence attached, and at another free.

January 15, 1868.

The President in the chair. Forty-eight members present.

Capt. Nathaniel E. Atwood exhibited a cod fish, which presented a curious appearance. A number of sand-eels were seen in the walls of the abdominal cavity; they were so hard as to resist the knife, not at all decomposed, and in many places with a sort of earthy crust or membrane of their own. Capt. Atwood said the occurrence was not an unusual one, and the cod, being in good condition, had apparently not suffered at all by this phenomenon.

The President remarked that there were three noticeable features in this fish; the eels were all outside of the cavity of the stomach; they were enveloped in a membrane of their own, and, although they must have remained a long time in their present position, there were no signs of putrefaction. It has been held that the vital forces maintained life in antagonism to physical forces, and that when the vital force was gone, the physical force wrought immediate disintegration and decomposition of the organic tissues. Pasteur, however, by his experiments on animal tissues, had proved that decomposition does not depend on the abstraction of the vital principle, but on the presence of some disturbing agency.

Mr. Lucas Baker exhibited some earthy kernels as large as mustard seeds, foreign substances, which he had found in the body of the perch; according to his statement they rendered the fish unfit for food.

The Custodian announced the purchase of a collection of alcoholic specimens, principally fishes, obtained by Mr. J. A. Allen in Central Iowa; they were especially interesting from having been collected in small streams flowing down either side of the water-shed between the Mississippi and Missouri rivers; the exact localities were carefully specified.

Section of Entomology. January 22, 1868.

Mr. L. Trouvelot in the chair. Fourteen members present.

The following papers were read :—

ON THE DEVELOPMENT OF A DRAGON-FLY (DIPLAX). BY A. S. PACKARD, JR., M. D.

1. In all the eggs observed, the blastoderm had been formed, and consequently the nucleated blastodermic cells had disappeared, and, at this stage, there was a clear space about what is probably the anterior pole of the egg, where the head is eventually to be developed.

2. In the next stage (Fig. 1.) the head is partially sketched out, with the rudiments of the limbs and mouth-parts; and the sternites, or ventral walls, of the thorax and of the two basal rings of the head appear. The anterior part of the head, including the so-called "procephalic lobe" overhangs and conceals the base of the antennæ. It is probable that more careful observation would have shown the end of the abdomen folded back upon the *dorsal* region, as usual at this period in the embryos of the insects and crustaceans whose embryology has been studied.

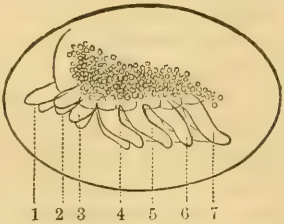

Fig. 1.

Side-view of embryo. The procephalic lobe is not shown. 1, antennæ; 2, mandibles; 3, maxillæ; 4, second maxillæ (labium); 5–7, legs. These numbers and letters are the same in all the figures. The under-side (sternum) of six segments are indicated.

The antennæ, mandibles and maxillæ form a group by themselves, while the second maxillæ (or labium) are very much larger and turned backwards, being temporarily grouped with the legs.

There are traces only of the two basal sterna of the abdomen. This indicates that the basal abdominal segments grow in succession from the base of the abdomen, the middle ones appearing last. The post-abdomen has probably been developed synchronous with the procephalic lobe, as in all insect and crustacean embryos yet observed. As observed by Zaddach, these two

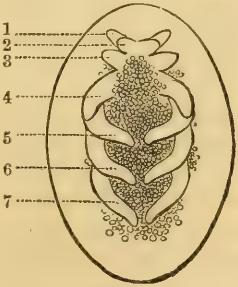

Fig. 1, *a*.
Ventral view of the same.

lobes in their development are exact equivalents; there is an antero-posterior symmetry very clearly shown. But in this stage (Fig. 1), after the two ends of the body have been evolved from the primitive cell-layer, development in the post-abdominal region is retarded, that of the cephalic region progressing with much greater rapidity; thus the statement is true, that thenceforward the body develops from before backwards.

The development of the hinder, or post-oral, rings of the head. together with the antennal segment, *i. e.*, the first one in front of the mouth, accords at this time with that of the thoracic segments, so that the process of development of the two regions and their appendages is nearly identical.

3. In the next stage (not figured) the yolk is completely walled in, though no traces of segments appear on the dorsal and pleural areas. The revolution of the embryo has taken place; the post-abdomen being curved *beneath* the body. The eggs being oval, the change in position of the posterior end of the abdomen is not so well marked as in eggs of a spherical shape, where the embryo has less room to develop. This change of position may in part be accounted for by the increased size of the median part of the abdomen, which thus pushes the head (which meanwhile contracts) forward nearer the end of the egg, so as to allow the post-abdomen to slip downwards and rest on the ventral wall of the body. The yolk granules fill the entire cavity of the body, extending into the appendages. The head has enlarged, the remaining abdominal sternites appear, and the abdominal lobe, or post-abdomen, is indicated, being curved under the body, and its end touching the middle of the abdomen.

The rudiments of the eyes appear as a darker, rounded mass of cells indistinctly seen through the yolk-granules, and situated at the base of the antennæ. They consist of a few epithelial cells of irregular form, the central one being the largest. The three anterior appendages, when seen sideways, are equal in size and length, the antennæ being very contiguous to each other.

The second maxillæ are a little over twice the length of the first maxillæ and are grouped with the legs, being curved backwards. They are, however, now one-third shorter than the anterior legs. The second-maxillary sternum is still visible.

The legs are now unequal in size, the two anterior pair being of the same length, though the middle pair are slightly thicker than the first pair; while the third, or posterior pair, are a third longer, and drawn back upon the side of the body, the ends nearly reaching the end of the egg.

The tip of the abdomen (post-abdomen) consists of four segments, the terminal one being much the larger, and obscurely divided into two obtuse lobes.

The abdominal sterna (urites) are now well marked, and the nervous cord is represented by eight or nine large oblong-square (seen sideways) ganglia, which lie contiguous to each other.

The formation of the eyes, the post-abdomen, the sterna, and median portion of the nervous cord seems nearly synchronous with the closing up of the dorsal walls of the body over the yolk-mass, though the division of the tergum into segments has not apparently taken place.

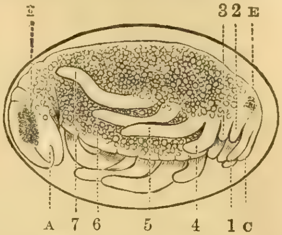

Fig. 2.

An embryo much farther advanced. C, clypeus, forming a part of the "procephalic lobe;" E, eye; A, bi-lobed extremity of the abdomen; I, the rudiments of the intestines.

4. The succeeding stage (Fig. 2; compare Zaddach's fig. 40) is signalized by the appearance of the rudiments of the intestine, while the second maxillæ are directed more anteriorly.

In form the body is ovate-cylindrical, and there is a deep constriction separating the post-abdomen (as we may call the temporary sub-division of the abdomen, which would seem to be permanently retained in the scorpions and some of the higher crustacea, *Homarus*, etc., where it forms the expansion at the tip of the abdomen) from the anterior part of the abdomen.

The terminal (11th) ring is immensely disproportioned to its size in the embryo just previous to hatching (see Fig. 4 where it forms a triangular piece situated between its appendages, the anal stylets). At a later period of this stage two more abdominal segments have been added, one to the end of the main body of the abdomen, and another to the post-abdomen. They have been apparently *interpolated* at the junction of the post-abdomen to the abdomen proper. Should this observation be proved to be correct, it may then be considered as a rule that, after reaching a certain number of segments, all additional ones are interpolated between the main body of the abdomen and its terminal segment or segments. This is the law of increase in the number of segments in Worms, and in Myriapods (*Iulus*, according to Newport's observations), in Arachnids (Claparède), and Crustacea (Rathke).

5. This stage (Fig. 3), is characterized by the differentiation of the head into the ophthalmic ring, or its rudiments, the eye-bearing piece, and the supra-clypeal piece, and clypeus, together with the approx-

imation of the second pair of maxillæ, which, united, form the labium, the extremities of which are now situated in the middle of the body.

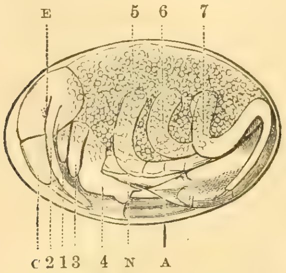

Fig. 3.

The embryo still farther advanced. N, ganglia.

The antennæ now extend to the middle of the labium, passing just beyond the extremities of the mandibles and maxillæ. The suture separating the eye-bearing piece from the antennary, mandibular, and maxillary pleurites and supra-clypeus, is distinct; the clypeus is now very distinct, and as large, seen laterally, as the supra-clypeus, though differing from it essentially in form. The œsophagus can now be seen going from the mouth-opening and situated just beneath the labium. It curves around just behind the eyes. There are at this period no appearances of movable blood-discs or of a dorsal vessel.

The abdomen is now pointed at the extremity and divided into the rudiments of the two anal stylets, which form large, acute tubercles. The yolk mass is now almost entirely enclosed within the body walls, forming an oval mass.

Another embryo, observed July 27th, had reached about the same stage of growth. The procephalic lobe, including the antennary segment, is farther advanced than before. The entire head is divided into two very distinct regions; *i. e.*, one *before* the mouth-opening (the *pre-oral* region, including the *ocellary*, or first and second segments; the *ophthalmic*, or third segment, and *antennary*, or fourth segment of the head); and the other *behind* the mouth. (*post-oral*, consisting of the *mandibular*, or fifth segment, the *first maxillary*, or sixth segment, and the *second maxillary*, or *labial*, being the seventh and last cephalic arthromere).*

6. At this stage, the embryo is quite fully formed, and is about ready to leave the egg. The three regions of the body are now distinct. The articulations of the tergum are present, the yolk mass being completely enclosed by the dorsal walls. The ventral ganglia are fully formed and are seen laterally to be square, with the square ends opposed, though the commissures cannot be distinguished. More careful observation will undoubtedly reveal their presence. The

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* These observations confirm our theory of the number of segments composing the head of insects as given in these Proceedings, Vol. x, p. 288. Readers will, however, please *dele* lines 11—14, and 25 on p. 289, as the succession of appendages there given is now believed by the author to be erroneous.

body is so bent upon itself that the extremities of the second maxillæ just overlap the tip of the abdomen.

The front of the head is now still farther differentiated. The supra-clypeal piece seems to be merged with the ophthalmic ring, the sutures between them having disappeared. The insertions of the antennæ are removed higher up to just in front of the eyes, or rather the eyes have dropped down, as it were. The clypeus is broad and large, and the bilobate labrum is separated from it by a suture. The mandibles and maxillæ are still tubercular in shape, the teeth of the former not yet appearing. The two limbs of the labium are now placed side by side, with the prominent spinous appendage on the outer edges of the tip. These spines are the rudiments of the labial palpi.

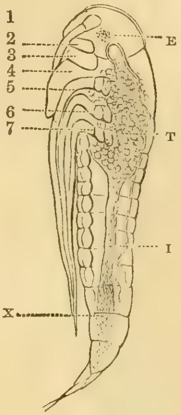

Fig. 4.

The embryo taken from the egg, but nearly ready to hatch. T, the dotted line crosses the main trachea, going through the yolk mass, now restricted to the thoracic region. At X, the tracheæ send off numerous branches around an enlargement of the intestine (colon), where the blood is aerated; better seen in fig. 5. The abdomen consists of eleven segments, the last being a minute triangular piece.

The legs are long and bent partially back on themselves; at the angles partially articulated. The femoro-coxal joints are very distinct, the tarsi are directed upwards and the two claws are simple, straight, and equal in size. The tip of the abdomen ends in two unequal pairs of stylets, terminating in a long bristle.

6, *a*. (Fig. 4.) The general form of the embryo at a still later period, on being taken from the egg and straightened out, reminds us strikingly of the Thysanura, and, in these and other respects, shows quite conclusively that the Poduræ and Lepismæ, and allied genera, are embryonic, degraded forms of Neuroptera, and should therefore be considered as a family of that suborder. Seen laterally, the body gradually tapers from the large head to the pointed extremity. The body is flattened from above downwards. At this stage the appendages are still closely appressed to the body.

7. This period occurs just before the exclusion of the embryo, and the limbs are still laid along the body. They, however, with the mouth-parts, stand out freer from the body. The labium, especially, assumes a position at nearly right angles to the body. The antennæ, mandibles, and maxillæ are now free, and have taken on a more definite form, being like that of the young larva, and stand out free from the

body. The head is much smaller in proportion to the rest of the body, and bent more upon the breast.

8. *The Larva* (Fig. 5). When hatched it is about .05 inch in length. The head is now free and the antennæ stand out free from the front. The thorax has greatly diminished in size, while the abdomen has become wider, and the limbs very long; and the numerous minute tubercles seen in the preceding stage have given origin to hairs. The dorsal vessel can now, for the first time, be seen. When in motion, the resemblance to a spider is most striking. The nervous ganglia are from one-fourth to one-fifth as wide as the abdomen itself, and are connected by two slender commissures. The flow of blood to the head, and the return currents through the lacunar or venous circulation along the sides of the body are easily observed. The vessels were not crowded with blood discs, the latter being few in number, only one or two passing along at a time. Two currents passing in opposite directions, were observed in the legs.

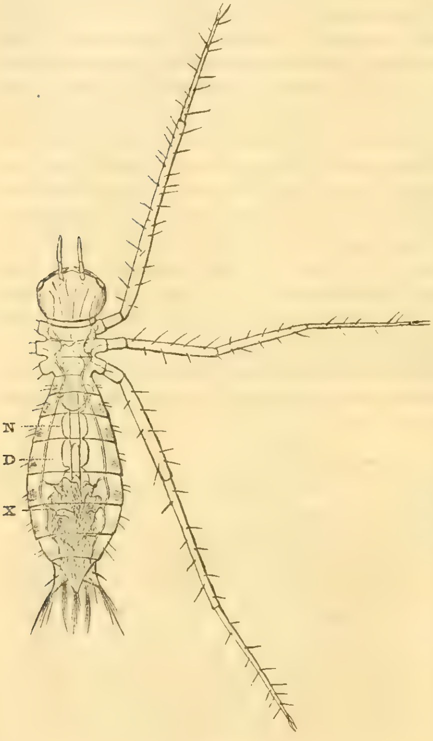

Fig. 5.

The larva just hatched and swimming in the water. N, ventral cord or nervous ganglia; D, dorsal vessel, or "heart," divided into its chambers. The anal valves at the end of the abdomen, which open and shut during respiration, are represented as being open. Both of the dotted lines cross the tracheæ. X, net-work of the tracheæ, surrounding the cloaca.

The young larva differs remarkably from the mature larva (which for the most part differs from the pupa (Fig. 6) only in the smaller eyes and absence of the rudiments of wings), in the much shorter legs and shorter abdomen, and the presence of the deciduous tubercles.* (Fig. 7.)

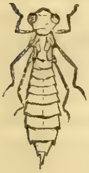

Fig. 6.

The pupa of Diplax, in which the eyes are much larger, and the legs much shorter than in the recently hatched larva.

Individuals were seen which were supposed to have undergone their first moulting, being nearly as large again as the freshly hatched larva and with the abdomen a little longer. The assumption of the mature larva-form seems to be in some respects a process of degradation. The pupa is more *decephalized* than the recently hatched larva, as the body is lengthened out backwards. In the changes from the pupa to the imago, the insect seems to go through a process of decephalization, or degradation, observable in the greatly disproportioned head, and elongated, cylindrical, worm-like abdomen. This shows that the Libellulidæ, while the most typical of Neuroptera, belong to a degraded form of the suborder, and stand low down in the group. On the contrary, the most typical of the Hymenoptera, (the honey bee, for example) and of the Lepidoptera, (*e. g.*, the butterfly) stand highest in their respective suborders.

The larvæ after hatching were not observed through their transformations. It is probable that, like the young Ephemera, which, according to Lubbock, moults twenty times before assuming the imago or winged state, the young dragon-fly moults *more* than four or five times, the usual number in the insects with complete metamorphoses.

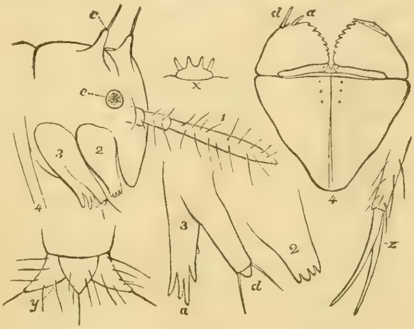

Fig. 7.

Considering the ocelli as indicating two segments in the head (these Proceedings, x., pp. 28, 29), we have seven segments forming the head, three the thorax, and eleven the abdomen. The typical number, then, may be considered as amount-

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* Figure 7. Side view of the head of the larva of Diplax before the first moult. *c*, deciduous tubercles terminating in a slender style; their use is unknown; they have not been observed in the full-grown larva. *e*, the compound eyes. 1, the three jointed antennæ, the terminal joint nearly three times as long as the two basal ones. 2, the mandibles, and also enlarged, showing the cutting-edge divided into four teeth. 3, maxillæ divided into two lobes: *d*, the outer and anterior lobe, 2-jointed, the basal joint terminating in two setæ; and *a*, the inner lobe concealed from view, in its natural position, by the outer lobe, *d*. 4, the base

ing to twenty-one, though often there are but ten abdominal rings. The embryo of Diplax in this respect presents more degradational characters than the embryo of Phryganea, described by Zaddach, where the abdomen consists of but ten segments.

No sexual organs were observed in the embryo, or young larva, though they may yet be discovered on more careful examination.

Mr. S. H. Scudder compared the symmetry of the fore and hind parts of these embryos with that of the embryos of vertebrates, recently described before the Society by the President. This symmetry was produced in the two groups in diametrically opposite ways. In vertebrates, the different parts develop gradually from the centre toward the two extremities; in articulates, the succession of growth is from the extremities toward the centre.

ON LACHLANIA ABNORMIS, A NEW GENUS AND SPECIES FROM CUBA BELONGING TO THE EPHEMERINA. BY DR. H. HAGEN.

In a very excellent collection of insects from Cuba received by the Museum of Comparative Zoölogy from Mr. Wright, in the winter of 1867–1868, I found six female imagos of an Ephemerideous insect. When I first saw them, their habitus induced me to suppose that the insect belonged to the most abnormal Ephemerideous genus *Oligoneuria* Pictet. This genus is very remarkable for the abortive condition of the legs, these organs being so greatly atrophied, that they must be nearly useless for the purpose of locomotion; remarkable also for the strength of the few longitudinal veins in the wings, and the rarity of transverse veinlets, which exist only near the anterior margin of the fore wings; remarkable also for the very singular appendage at the base of the fore wing, lodged below the heart-shaped apex of the mesothorax; remarkable finally for the curious strength of the junction of the fore and hind wings, which has induced such excellent Entomol-

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or pedicel of the second maxillæ, or labium, the expanded terminal portion being drawn separately; *d* and *a*, two movable stout styles representing, perhaps, the labial palpi; the lobe to which they are attached is multidentate, and adapted for seizing its prey; on the right side the two styles are appressed to the lobe. *x*, represents, perhaps, the ligula: but we have not yet studied its homologies carefully; this part is attached to a transversely linear piece soldered to the main part of the labium. *y*, the 11th abdominal tergite, with its pair of conical anal styles. z, the last tarsal joint and pair of long slender claws. All the drawings in this article, except Figure 6, were made from nature and put on wood by Mr. J. H. Emerton of Salem, to whom I am indebted for many facts noticed and communicated to me while making these drawings.

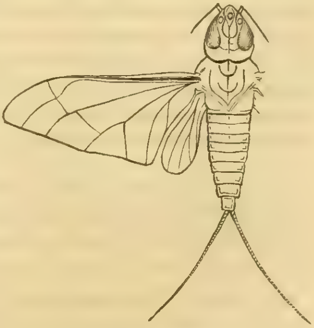
ogists as Dr. Imhoff in Bâle and the late Senator von Heyden in Frankfort to state erroneously that the fore and hind wings are united.

Pictet has founded the genus on a female in dry state from Brazil, *O. anomala*. Dr. Imhoff has since described *O. Rhenana*, which swarms in a great part of Central Europe. Probably the pair from Hungary, described by me in the Stettin Zeitung, 1855, p. 268, and the species figured by Costa from Naples are the same. Mr. M'Lachlan, in the Entomological Monthly Magazine for January, 1868, p. 177, described a third species from a single female, *O. Trimeniana*, from Natal. He mentions that he saw a few years since in the Museum in Paris a species from Mexico, but neglected to make a description of it. From a drawing of the fore-wing, received in a letter from him, I am induced to believe that the species now before me from Cuba may be the same, or at least, belongs to the same genus. An accurate examination of the six females from Cuba has convinced me that it cannot be placed under *Oligoneuria*. The neuration of the wings, and the number of the caudal setæ separate them very clearly, and I propose for the new genus the name *Lachlania*.

Lachlania abnormis Hag.

Fem. fusca, subtus pallida; capite nigro, prothorace nigro-fusco, lato, margine postico medio emarginato; setis albidis; pedibus nigris; alis griseis, semihyalinis, venis griseo-fuscis crassioribus; anticis quatuor longitudinalibus, primâ, secundâ et quartâ furcatis; transversis tribus, intermediis; alis posticis venis longitudinalibus tribus, mediâ furcatâ; transversis nullis.

Patria Cuba. Dom. Wright. In Mus. Cambridge. Long. corp. 6–7 millim.; exp. alar. ant. 18–20 millim.; long. setar. 5 millim.


Lachlania abnormis.

Head black, broader than long; eyes large, globular, separated; vertex a little longer than broad, oblong, depressed; the posterior margin rounded and a little emarginated in the middle, separated by an impressed transversalline, from which diverges a similar median longitudinal line, ending in an anterior impressed line, surrounding a circular flat elevation before the ocelli; the three ocelli globular, well marked, the middle one a little advanced; face with a membranous, gray, triangular lobe standing out in front, truncated before; antennæ with two inflated pale, basal joints, and a long blackish terminal seta; the basal joint is mostly concealed in the large orbit.

Prothorax black-brown, much broader than the head, flat, short rounded behind, the margin a little emarginated in the middle. Thorax brown, polished above, pale beneath, stout, cordiform and subinflated behind. Abdomen light brown, beneath paler, conic, a little depressed, the lateral margins produced into teeth, more noticeable in the penultimate segment; the ultimate segment truncated; the oviparous lobe on the antepenultimate ventral segment oblong, rather broader than long, the margin a little emarginated; a mass of greenish eggs is protruded. The two abdominal setæ white, a little shorter than the abdomen (the end is broken), slender, with short joints, glabrous, with very little pubescence at the tips. Legs black, the basal articulation very much developed; the femora probably stout and short; the tibiæ and tarsi atrophied, not adapted for an accurate description in the dry state.

Wings grayish, semi-opaque, without ribs at the margins; fore wings long, broad, triangular, with four very strong longitudinal, grayish brown veins; the first, third and fourth, furcate from behind about the middle; the furcate vein of the third not so strong as those of the others; the furcate vein of the fourth going to the middle of the abdominal margin. Three strong transversal veins (no others exist) about in the middle of the wing, rather nearer to the tip, unite the first with its furca, the second and the third; but the transversals are not always exactly in the same line; at the base of the fore wing is a long, very small membranous appendage lodged under the prominent edge of the mesothorax as in *Oligoneuria*. Hind wing not in good condition for examination; it seems to have three longitudinal veins, the middle furcated; no transversal veins. The fore border of the hind wings is very closely pressed against the corresponding border of the fore wings, as in *Oligoneuria*. The border seems to be more opaque and scabrous than the rest of the wing.

The character of the genus Lachlania can not be given completely, until the male is known. But it is evident that the species can not be placed under *Oligoneuria*. Two abdominal setæ instead of three, and three strong transversal veins in the middle of the wing are the the most evident characteristics of *Lachlania*. The last is very exceptional in the family of the *Ephemerina*, and gives to the animal a very strange and abnormal appearance.

Dr. Hagen further remarked that Mr. Burgess had kindly communicated to him two american species of *Psocus* arranged as microscopical objects.

One of them is very interesting, belonging to the genus *Clothilla* Westwood, with 3-jointed tarsi, slightly dilated femora, 24-articulated antennæ and short, scale-like wings. This species is certainly different from *Cl. picea* Hag. from California, the only described american species. I think the species communicated is very similar, probably identical with *Clothilla studiosa* Westw., formerly described by Linnæus as *Termes pulsatorius*, and afterwards always confounded with *Atropos divinatorius* Muell. I may add that I have positively found the last species in the boxes of the Cambridge Museum, containing a collection of Australian insects, and O. Fabricius found the same species long since in Greenland.

The other species, with two jointed tarsi, 10-articulated antennæ, without elytra and ocelli, is apparently a young larva of a species of *Psocus*. I think it cannot be the *P. lucifugus* Ramb., a doubtful and much larger species.

SUPPLEMENT TO A LIST OF THE BUTTERFLIES OF NEW ENGLAND. BY SAMUEL H. SCUDDER.

Five years ago, I published, in the third volume of the Proceedings of the Essex Institute (Salem, Mass.), a list of New England butterflies. Eighty-one species were enumerated, together with the time of their appearance in each successive stage, the localities which they frequented, and the comparative abundance in which they were found. In the following paper I have endeavored to extend our knowledge of their relations to the outer world, and correct the mistakes that must naturally creep into a first attempt of the kind; the names of other butterflies now known to inhabit New England have also been inserted. Ninety-three species are enumerated, and the numbers by which those of the previous list were specified are prefixed in parentheses.

I am indebted for my material to the favor of many friends, among whom I may mention Mr. S. I. Smith of Norway, Me., Messrs. F. G. Sanborn and J. C. Merrill, Jr., of Boston, and Mr. P. S. Sprague of Dorchester. Professor A. E. Verrill has kindly lent me some of the butterflies of Yale College Cabinet for examination.

1. (1.) **Papilio Asterias** Drury. The first brood may appear as early as the 10th of May, and good specimens of the second can be found as late as the middle of September; larvæ, which changed to chrysalids, July 27th and August 3d, in Norway, Me. (Smith), escaped May 27th and 29th of the following year.

2. (2.) **Papilio Troilus** Linn.

3. (3.) **Papilio Turnus** Linn. Extremely abundant in the

north. When in Northern Maine, Mr. F. W. Putnam caught sixty-nine specimens between his hands at once. Mr. Smith tells me that, in 1864, in Norway, Me., the first specimens were seen on the 31st of May; they began to be abundant by the 4th of June, grew scarce on the 20th, and disappeared by the 27th of the same month. One larva, which changed to a chrysalis August 12th, appeared as an imago (in confinement) April 29th; the larva was found on the trunk of the wild thorn, August 15th.

4. (4.) **Papilio Philenor** Drury.

5. (5.) **Pieris oleracea** Boisd. I took one specimen at the White Mountains, June 17th; several specimens were seen daily at Jefferson, N. H., from July 10th to August 10th; toward the latter part of the time they grew more abundant. Mr. Merrill found good specimens common in Vermont, the last of August and early in September. Mr. Smith has taken them, September 16th, in Norway, Me.

6. **Pieris rapæ** Schrank. This butterfly, first discovered in North America in the vicinity of Quebec, by Mr. G. J. Bowles, has spread into the northern parts of New England. Mr. Merrill has collected it in Stowe, Montpelier and Waterbury, Vt., during the latter part of August, and Mr. Sprague has found specimens abundant in Lewiston, Me.

7. **Pieris Protodice** Boisd and Lec. While walking in Boston with Dr. Packard, Sept. 1st, I saw a single fresh specimen of this species in close proximity. Mr. Smith has taken several specimens in New Haven, Conn.

8. **Colias Eurytheme** Boisd. Mr. Sprague captured a single specimen in Montpelier, Vt. Mr. T. F. McCurdy has one in his collection, taken in Norwich, Conn.

9. (6.) **Colias Philodice** Godt. Mr. Merrill does not think specimens are rare in June, but when I have taken them at that time they have been generally old and worn. I captured a number of specimens at Hampton. N. H., July 8th; they seemed to confine their flight to the open fields on the sea coast, never reaching the woods, less than a quarter of a mile from the shore; only a few were seen July 22d, and I am inclined to think that the second brood appears early and not late in July. At Jefferson, N. H., during July and August, this species is less abundant than *Pieris oleracea*. Mr. Merrill found the white variety of the ♀ quite common, September 9th, and thinks it is generally much more abundant in the second than in the first brood. I have also noticed this to be the case.

10. (7.) **Terias Lisa** Boisd.

11. (8.) **Terias Delia** Boisd.

12. **Anthocaris Genutia** Boisd. Mr. Smith took a single specimen, May 16, in New Haven, Conn.

13. (9.) **Chrysophanus americanus** D'Urban.

14. (10.) **Chrysophanus Thoe** Westw.

15. (11.) **Chrysophanus Epixanthe** Westw. This species was very abundant at Hampton, N. H., July 22d. I captured over thirty specimens in a single hour, in a dried up, boggy meadow, from which the grass had just been cut; none were found by the roadsides. I also took specimens July 8th, and they were found by Mr. Merrill on the cranberry, July 2d and 8th.

16. (12.) **Polyommatus Porsenna** Scudd. Mr. Smith has taken a number of specimens in Norway, Me., in June, and July 20th and 28th. Mr. A. Shepard has taken them in Plantsville, Conn., (Yale College Mus.).

17. (13.) **Lycæna neglecta** Edw. Taken on Cape Cod in September.

18. (14.) **Lycæna Lucia** Westw.

19. (15.) **Lycæna Comyntas** Westw. Mr. Merrill has taken this species throughout May.

20. **Thecla Clothilde** Edw. A single specimen of this most beautiful addition to the number of New England butterflies was taken by Mr. Smith on Streaked Mountain, near Paris, Me., July 22d. The following description was taken from Mr. Edwards's specimen several years ago.

♂. Wings above dark ashy-brown, with a few scattered bright blue scales, giving it a cærulean tint at the base of primaries, and on the disk of secondaries. On the primaries, above the median nervure, an indistinct subapical dark patch, resulting from the interspersion of black scales; a very few deep orange scales at the extremity of the submedian nervure on the inner angle of secondaries.

Beneath uniform, lustrous, light ashy-brown. Primaries with a straight series of small, generally indistinct, deep orange spots, narrowly bordered externally, with occasional dark scales, the series commencing on the costal border, at three-fourths of the distance from the base, and terminating at the lowest branch of the median nervure. Secondaries with a submarginal and a mesial row of similar spots, the submarginal series very minute away from the inner angle, and usually without any accompanying dark scales; the mesial situated a little beyond the middle of the wing, each parallel with the outer border. Expanse of wings .8 inch.

21. **Thecla acadica** Edw. Messrs. Grote and Robinson state that I sent them specimens of this species from Cape Cod; I may have mistaken it at the time for *T. Falacer*, which it closely resembles, but from which I believe it is distinct; a specimen in Dr. Harris's collection comes from Nashua, N. H., and Mr. Merrill has a specimen from New England.

22. (16.) **Thecla Falacer** Harr. Mr. Merrill found a few good specimens near Boston, June 22d and July 4th, and poor specimens at Bellows Falls, Vt., September 4th. Mr. Smith has taken a number of specimens at Norway, Me.

23. (17.) **Thecla strigosa** Harr. Mr. Sprague has taken this rare species near Boston, and Mr. Smith found one specimen at Norway, Me.

24. (18.) **Thecla humuli** Harr.

25. (19.) **Thecla auburniana** Harr. This species is not uncommon about New Haven, and Mr. Merrill has taken it abundantly upon red cedars, near Boston, the last of May and the middle of June.

26. (20.) **Thecla Niphon** Boisd. and Lec. Taken May 25th by Mr. Merrill at Lynn, Mass.; also at Norway, Me., by Mr. Smith.

27. (21.) **Thecla Mopsus** Harr. Mr. Smith has collected this species in abundance at Norway, Me. It has also been captured in Guilford, Conn. (Yale College Mus.).

28. (22.) **Thecla Augustus** Kirby. Mr. Smith found this species very common in Norway, Me., from April 18th to May 18th. Mr. Merrill collected it about whortleberry bushes near Boston, May 25th.

29. **Thecla Henrici** Grote and Robinson. This species, closely allied to *T. Augustus*, has been taken in New England by Mr. Smith alone; he obtained a few specimens in Norway, Me., and New Haven, Conn., the latter May 31st.

30. (23.) **Danais Erippus** Doubl.

31. (24.) **Limenitis Misippus** Harr. According to Mr. Smith, the second brood of this butterfly begins to appear in August, and is rare by the last of September. Mr. Merrill observed it from June 13th to July 15th, and from August 7th to the end of September.

32. (25.) **Limenitis Ursula** Boisd. and Lec.

33. (26.) **Limenitis Arthemis** Boisd. and Lec. The first brood appears at the White Mountains about the 18th of June, and lasts until the middle of July; during the latter month, but few perfect specimens can be found; the second brood appears the last of August.

34. (27.) **Argynnys Idalia** Godt.

35. (28.) **Argynnys Cybele** Godt. I have not yet seen a specimen from New England.

36. (29.) **Argynnys Atlantis** Edw. Fresh specimens were not uncommon at the White Mountains June 17th; the late Mr. C. A. Shurtleff found chrysalids at Eastport, Me.; they are suspended by the tail beneath rails, boards or logs, lying on the ground.

37. (30.) **Argynnys Aphrodite** Fabr. One brood appears

about the middle of June, and lasts a month; specimens found toward the end of July are always battered; as they have been taken by different persons during the latter part of August, and nearly up to the middle of September—at the latter time battered—there is probably a second brood.

38. (31.) **Argynnys Myrina** Godt. This is not an uncommon species.

39. (32.) **Argynnys Montinus** Scudd. Mr. Walter Faxon captured one specimen, and saw several others on Mt. Clinton, White Mountains, N. H., August 1st.

40. (33.) **Argynnys Bellona** Godt. The first brood lasts from the middle of May to the middle of June; specimens are also found abundantly early in September.

41. (34.) **Euptoieta Claudia** Doubl.

42. (35.) **Melitæa Nycteis** Doubl. I have compared my *M. Œnone* with types of *M. Nycteis* in Boisduval's collection, received directly from Doubleday, and find the two to be identical. Mr. Smith took this species at Norway, Me., June 19th, and Mr. Sprague at Lewiston, Me., in July.

43. (36.) **Melitæa Harrisii** Scudd. The synonyms of this species given in my previous list were inserted there by mistake; they belong to the previous species *M. Nycteis* (*Œnone*). This butterfly has been found in abundance at Norway, Me., and has been reared by Mr. Smith; the larvæ feed on *Diplopappus umbellatus*; they changed to chrysalids from June 13th to 29th, remained in the chrysalis from ten to sixteen days, and the butterflies appeared from June 20th to August 1st. Mr. Sprague has taken this species in Montpelier, Vt., June 30th, and I have taken poor specimens at the White Mountains, June 17th.

44. (37.) **Melitæa Tharos** Boisd. and Lec. Found by Mr. Merrill the last of May. I collected abundant specimens of the second brood at Hampton, N. H., August 12th.

45. (38.) **Melitæa Phaëton** Boisd. and Lec. Dr. A. S. Packard, Jr , has seen the caterpillar feeding on *Aster*, *Viburnum dentalium* and *Corylus americana* in Brunswick, Me. I have found the butterfly abundant twice; once at Williamstown, Mass., in May or June, and again at the White Mountains, June 17th.

46. (39.) **Pyrameis Cardui** Doubl. Several specimens, but in poor condition, were taken at Norway, Me., and the White Mountains, N. H., during the latter half of June.

47. (40.) **Pyrameis Huntera** Doubl.

48. (41.) **Pyrameis Atalanta** Hübn. I saw one fresh specimen at Hampton, N. H., July 8th.

49. (42.) **Junonia Cœnia** Hübn. A fresh specimen was collected at Hampton, N. H., August 12th.

50. (43.) **Vanessa Antiopa** Ochs. Rubbed specimens only were found at Owl's Head, Lake Memphramagog, August 15th.

51. (44.) **Vanessa J-album** Boisd. and Lec. Mr. Smith writes me that the broods of this species correspond perfectly with those of *V. Antiopa;* specimens were taken by him at Norway, Me., April 8th (abundant), July 23d, the last of August and throughout September.

52. (45.) **Vanessa Milberti** Godt. I found this butterfly common in July at Jefferson, N. H.; some were seen in August; it is common in the early part of September at Norway, Me., and Mr. Merrill has taken it at the same time.

53 (46.) **Grapta interrogationis** Doubl.

54. (47.) **Grapta C-argenteum** Kirby.

55. **Grapta gracilis** Grote and Robinson. The peculiar hoary-banded form of *G. C-argenteum*, mentioned by me as found at the White Mountains, was also taken by Mr. Sanborn, August 12th; specimens sent by him to Mr. Grote were recently described by the latter, under the name of *G. gracilis.* I have since taken specimens near the White Mountains at Jefferson, N. H.

56. (48.) **Grapta comma** Doubl.

57. (49.) **Grapta Faunus** Edw.

58. (50.) **Chionobas semidea** Edw. I have taken specimens as early as June 19th.

59. (51.) **Satyrus alope** Boisd. and Lec. I did not place the name of *S. Nephele* in my former list, because I was inclined to consider it a synonym of *S. Alope.* I still exclude it for the same objection, which Mr. Edwards's considerations have not fully overcome.

60. (52.) **Satyrus Portlandia** Boisd. and Lec. I captured two broken specimens in Jefferson, N. H., late in July.

61. (53.) **Hipparchia Boisduvalii** Harr. Found only in moist meadows, not in pastures; collected early in July, by Mr. Smith, at Norway, Me. I found it abundant at Jefferson, N. H., late in July, but more than half of the specimens were broken.

62. (54.) **Neonympha Eurytris** Westw. Mr. Smith found this butterfly very abundant and in good condition at Norway, Me., June 19th.

63. (55.) **Libythea Bachmanii** Kirtl.

64. (56.) **Heteropterus marginatus** Harr. Captured by Mr. Merrill, June 22d.

65. (57.) **Nisoniades Juvenalis** Westw.

66. (58.) **Nisoniades Persius** Scudd. The first brood of this

species appears near Boston quite abundantly, as early as the middle of May, and continues throughout June. Mr. Smith has found it common in the middle of June, especially by roadsides, at Norway, Me.

67. (59.) **Nisoniades Brizo** Westw.

68. (60.) **Nisoniades Catullus** Westw.

69. (61.) **Eudamus Tityrus** Boisd. and Lec.

70. (62.) **Eudamus Lycidas** Boisd. and Lec. About the middle of June, Mr. Sanborn captured a fresh specimen in the vicinity of Boston.

71. (63.) **Eudamus Bathyllus** Boisd. and Lec.

72. (64.) **Hesperia Metacomet** Harr. Mr. Smith took several specimens in Norway, Me., July 3d.

73. **Hesperia verna** Edw. One specimen has been taken by Mr. C. P. Whitney, at Milford, N. H.

74. (65.) **Hesperia Massasoit** Scudd. Mr. Merrill has a single battered specimen from Milton, Mass., taken June 15th.

75. (66.) **Hesperia Hobomok** Harr.

76. **Hesperia Quadaquina** nov. sp. Wings above dark mulberry-brown; primaries maculated with white (the spots arranged as in *H. Pocahontas*), and sometimes slightly suffused, especially about the centre, with hoary scales; secondaries sometimes much suffused in the centre with fulvous. Beneath, the secondaries differ from those of *H. Pocahontas* in having a much narrower transverse band, situated further from the base of the wing; the outer border of the bands in the two species corresponds in position and direction. Mr. Walter Faxon captured a specimen June 11th, at the edge of a muddy pond in West Roxbury, Mass. Mr. Sanborn took a female in Quincy, Mass. It has also been found in Guilford, Conn., by Mr. Smyth, and in New Haven, Conn., by Mr. Smith.

77. (67.) **Hesperia Pocahontas** Scudd.

78. (68.) **Hesperia Leonardus** Harr. Taken at Guilford, Conn., by Mr Smyth (Yale College Mus.).

79. (69.) **Hesperia Mystic** Edw.

80. (70.) **Hesperia Sassacus** Harr.

81. (71.) **Hesperia Wingina** Scudd.

82. (72.) **Hesperia Wamsutta** Harr.

83. (73.) **Hesperia Egeremet** Scudd. A female in my collection was taken by Mr. Smith at Norway, Me. Mr. Smyth has also taken it at Guilford, Conn.

84. **Hesperia Acanootus** nov. sp. ♀. Wings above blackish-brown, secondaries more or less suffused in the centre with very pale fulvous; primaries with scattered fulvous scales, especially at the base and along the costal area; fringe at its base blackish-brown,

apical two-thirds whitish, pearly white on the inner border of secondaries, obscured with a brownish tint on the upper half of the outer border of primaries; primaries with four pale fulvous spots; two small inconspicuous dashes, one above the other, between the terminal divarication of the subcostal nervure and two larger subquadrate spots, lunated outwardly, the lower and larger situated between the first and second median nervules, its inner border nearly on a line with the outer border of the larger.

Beneath light yellowish-brown, deepest on the costal border of primaries; the inner and costal border of the secondaries narrowly and faintly, the inner border of the primaries broadly and deeply infuscated; the veins of both wings, but especially of the secondaries, whitish; the larger spots of the primaries reproduced beneath. Expanse of wings 1.4 inch. Collected by Mr. Sanborn during August, in meadows, at Lexington, Mass.

85. (74.) **Hesperia Manataaqua** Scudd. Mr. Merrill has collected several specimens of both sexes at Quincy, Mass., July 8th and 12th, and Mr. Faxon a single male at West Roxbury, July 9th.

86. (75.) **Hesperia Ahaton** Harr. Mr. Merrill does not think the female is very rare. I have found it to be much less abundant than the male.

87. (76.) **Hesperia Oneko** Scudd.

88. (77, 78.) **Hesperia Samoset** Scudd. *H. Hegon* is the same as *H. Samoset*: the name of *H. Hegon* may be suppressed as the description of *H. Samoset* was drawn up from more and better specimens. I have taken a fresh specimen at the White Mountains, June 17th, in a road through the woods, and Mr. Smith has found it at Norway, Me.

89. **Hesperia vialis** Edw. Mr. C. P. Whitney took one specimen in June, at Milford, N. H.

90. (79.) **Hesperia Metea** Scudd.

91. (80.) **Hesperia Manoco** Scudd. A single specimen in the Yale College Museum was taken in Guilford, Conn.

92. **Hesperia Hianna** nov. sp. Wings above dark lustrous-brown, darker at the base; fringe pale yellowish-brown, at the extreme base blackish-brown. Primaries with a row of three small, white, oval spots, increasing in size toward the costa, situated one between each of the terminal subcostal nervules near their divarication; a small circular (♂), or large squarish (♀), spot between the terminal median nervules, near their divarication; two small oval spots—one, or both, sometimes obsolete—one above the other near the extremity of the cell; in addition the ♀ has a large transversely subquadrate spot between the first and second median nervules, half-way between the divarication of the second and third nervules, and the

spot in their interspace; in continuation of the line connecting the median spots are two minute roundish or transversely oval obsolescent spots above, and a small roundish spot below; in the place of these, the ♂ has the sexual bar, which is indistinct, black, interrupted; it starts from the median nervure, just within, or at its last divarication, and passes in a straight, or very slightly incurved line, directed sharply inward to the first median nervule, so as to form with the latter an angle of about 45°; continuing from a point as far outside of this as its own width, it crosses the interspace between the median nervules, making a slight outward curve nearly parallel to the outer margin.

Beneath, dull chestnut-brown, the whole apex of both wings covered with a bloom of pearly white scales, lower outer angle of primaries dull brownish-white; the spots of the upper surface of the primaries are repeated beneath, but whiter; between the subcostal and median spots is a large quadrate spot, parallel to the costal border, of a dull brownish tint, twice as long as broad. The secondaries have a distinct circular spot of pearly white, narrowly annulated with black, situated at the base, between the first branches of the subcostal nervure; an indistinct mesial band, often obsolete, of the same color as the apex of the wing. Expanse of wings 1.4 inch.

This species is closely allied to *H. punctella* Grote and Rob.; it differs from it in the three subapical spots, which increase in size towards the costa, and have no pale spots surrounding them on the under surface; in possessing a large pale spot on the under surface of the primaries beyond the cell, and a white dot at the base of the under surface of the secondaries; possibly the black dash of the ♂ also differs in the two species.

This fine species has been taken by Mr. Sanborn at Quincy and Dorchester, Mass.

93. (81.) **Hesperia Panoquin** Scudd.

94. **Hesperia Mesapano** nov. sp. Resembles *H. Mandan* Edw. Wings above dark purplish-brown, variegated with dull orange spots; fringe dusky, blackish towards base.

Primaries with a large irregular spot in the cell; it consists, first, of a square spot which occupies the whole width of the cell, and has its outer limit at the second divarication of the median nervule; starting from a little beyond the lower inner angle of the square spot, where it is divided by the median nervure, it does not reach the subcostal nervure, and is obliquely truncated or rounded; there is a subapical row of spots; the three subcostal ones are wedge-shaped, their apices pointing inwards; the two between the suocostal and median nervures are smaller than the rest, sublunate, and situated so much further outwards that their inner border runs parallel to the outer border of the other spots; of the spots below these, the first is triangular, the second is largest of all and subquadrate, the third and fourth are unequal and oppositely rhomboidal; midway between these and the base of the wing is a small roundish spot.

Secondaries with two spots between the subcostal and median nervures, dividing equally the distance from the base to the tip of the wing, the inner ovate, and scarcely half as large as the outer roundish one; a third small ovate spot at the first divarication of the median nervure, and, sometimes, a fourth small ovate spot between the terminal divarications of the subcostal; sometimes a submarginal row of spots.

Beneath dull fulvous, the primaries with brownish spots, the secondaries with very large silvery white spots, encircled with yellowish brown; the darker parts of the primaries are as follows: the basal half of the wing, beneath the median nervure, fuscous; the basal two-thirds of the costal area obscured with fuscous; a dark spot occupying the upper half of the middle of the cell; a large oblong quadrate spot between the subcostal and median nervures, extending from just within the tip of the cell (where it encloses a yellow spot) more than half-way to the outer margin; above its basal third a slight infuscation; a quadrate spot between the first and second median nervules, its outer border reaching the second median nervule; a submarginal row of spots just without the row of yellow spots on the upper surface, those between the subcostal and median nervures sagittate. The spots on the secondaries are as follows: a very large oblong-oval one in the middle of the interspace between the subcostal nervure and its first nervule, two spots dividing equally the interspace between the subcostal and median nervures, the inner oblong-oval, as large as the first mentioned, the outer the largest on the wing, and subquadrate; the latter forms one of a straight discal row of spots subparallel to the outer border, the others being as follows: a spot similar to the first two mentioned, situated between the median and submedian nervures; a small roundish or ovate spot between the latter and the largest spot, and beyond the largest; a roundish or subtriangular spot, half as large as the first mentioned spot, situated near the outer angle; above this, at right angles to the extremity of the straight row, a small roundish spot; a submarginal row of five small roundish spots, those between the subcostal and median nervures small and marginal, sometimes obsolete. Expanse of wings one inch. Taken at Norway, Me., June 13th, by Mr. Smith.

Mr. S. H. Scudder stated that he had recently been studying the mole crickets, with a view to their classification, and found that they were naturally divisible into two groups. For one he retained the name of *Gryllotalpa*, under which all the species had formerly been grouped, and to the other applied that of *Scapteriscus ;* these two groups were separated by the following characteristics.

In *Scapteriscus* the posterior margin of the sternum of the eighth abdominal segment of the ♂ is produced into a stout prominent central tooth; in *Gryllotalpa* the margin is entire.

The mesosternal ridge of *Gryllotalpa* is prominent, and almost equally so throughout; that of *Scapteriscus* is never prominent on the anterior half of the segment, and is often limited to the posterior half, or is even obsolescent.

The fore trochanter of *Scapteriscus* is large; the free portion almost always equals the tibial dactyl in length, and is of about the same size at the tip as at the base; that of *Gryllotalpa* is proportionally small, seldom exceeding half the length of the tibial dactyls; the form is cultrate or lenticular.

Scapteriscus is furnished with only two fore-tibial dactyls, both of which are movable; *Gryllotalpa* has two movable dactyls besides a second pair which are immovable.

With but few exceptions, the hind femora of *Scapteriscus* more than equal the pronotum in length, while in *Gryllotalpa* they are always shorter than the pronotum.

In *Gryllotalpa* the length of all the hind tarsal joints taken together seldom exceeds half the width of the pronotum, while they equal its whole width in *Scapteriscus.*

The hind tarsal claws of *Scapteriscus* are clothed with short hairs nearly to the tip; those of *Gryllotalpa* have hairs only at the base.

The tegmina of *Scapteriscus*, with but few exceptions, cover, when at rest, two-thirds of the abdomen; in *Gryllotalpa* they seldom conceal more than one-half of the abdomen.

The nervures of the middle field of the tegmina in the females of *Gryllotalpa* are distant and rather irregular, somewhat resembling those of the males; in *Scapteriscus* they are approximate, regular and straight.

The anal cerci are longer than the pronotum in *Gryllotalpa ;* shorter in *Scapteriscus.*

Finally, the ninth, and sometimes the eighth abdominal segments are furnished above, in *Gryllotalpa*, with two transverse lateral rows of long hairs directed inwards, as if to keep the long folded wings in place; these are absent from *Scapteriscus*, where the wings are equally long and similarly folded.

Only one species of *Scapteriscus* has been found without the limits of South and Central America, and that—occurring in a single instance in Europe—must undoubtedly be considered an emigrant from the same warm regions; the members of the genus *Gryllotalpa*, on the contrary, are found throughout the whole world, not excluding Central and South America.

Comparing these two genera with their nearest allies, *Tridactylus*, *Cylindrodes*, etc., we find great and striking differences—differences which are extraordinary compared with those which divide *Scapteriscus* and *Gryllotalpa;* the comparatively simple fore tibia, and the abnormal appendages which supplant the hind tarsi in *Tridactylus*—the abbreviated legs fitting into cavities in the body, and the absence of articulated appendages at the extremity of the abdomen in *Cylindrodes*—these characteristics are far more important than the sexual sculpture of the abdomen, the ultimate neuration of the tegmina, the length of the legs, the contour of the trochanters, or the digitation of the tibiæ, which separate *Scapteriscus* and *Gryllotalpa.*

The facts cited above present two features which bear upon the question of the origin of species.

First: these little mole crickets, so unique in their structure as to be widely separated from their nearest allies, are spread uniformly over the whole surface of the globe; but few species occur in any one place, and at least one is found in every temperate or hot region.

Now, if species originate or change from physical causes, or by "Natural Selection," why is it that under every physical condition and surrounded by every variety of antagonism possible in their habitat, this same unique structural form has sprung up all over the globe?

Again, how can such theories account for another feature—common, indeed, to all natural groups—that it is not one striking characteristic which separates *Scapteriscus* and *Gryllotalpa*, and which "Natural Selection" might have seized upon, with reference to some special benefit, but a combination of features which have no apparent dependence upon each other, correlated, but not necessarily connected? Why should "Natural Selection," altering for its own purpose the palm of the four-fingered mole cricket into that of the two-fingered species in South America; or, developing in South America, from some previous synthetic form of mole cricket, both the present four-fingered and two-fingered species, and in other parts of the world the four-fingered species only—destroying at the same time the primæval form all over the surface of the globe—at the same time, place rows of hairs on the hinder part of the abdomen of the tetradactylate group, and none on that of the didactylate? or make the veins of the tegmina of the ♀ of one group distant and irregular, and those of the other straight and approximate? Why furnish the eighth abdominal segment of the ♂ of one with a projecting tooth, and deprive those of the others of such a prominence? Why give one long and the other short anal cerci, or clothe the hind tarsal nails of one with short hairs and leave the other naked? What have these features to do with the differences of structure we have mentioned in the palm-shaped fore leg, or in the length of the hind leg? These and similar difficulties, arising on every hand, seem to attend every derivative theory of the origin of species.

Dr. A. S. Packard, Jr., read the following account of two species of salt fly, by Mr. Cox:—

"I send you the larva and pupa of a dipterous insect (*Ephydra*) found in the salt brine at the salt works near Equality, Gallatin County, Illinois, in such prodigious quantities as to fill up the wooden conduit pipes. These pupæ are gregarious, collecting in masses, and form great rope-like bunches, by clinging around small fibrous roots on the sides of the little ditch that conveys the brine from the first 'Graduation or Thorn house,' to the pump at the furnace.

"The brine, as it comes from the well, has a strength equal to 7$\frac{8}{10}$ Baume, and is graduated after the German plan, by showering it successively over thorn bushes arranged on beams from top to bottom of three separate frames, from forty to forty-five feet high, called 'Graduation or Thorn houses.'

"What is remarkable in this is, that the above larvæ can nowhere be found except in the brine after first graduation, that is, passed over the first house, when they are found in such quantities as to prove a great nuisance. Neither in the fresh water, weak brine, or brine of second and third graduation can they be found at all.

"The people at the works believe that they are generated by some peculiar property in the water acquired after first graduation. I send them in their favorite brine. Professor Leo Lesquereux found a new species of plant in the brine pools. The short time at our disposal was so much taken up with geology, the object of our visit, that I forgot to collect specimens of the plant, which was abundant. I hope soon to revisit the locality, when I will try to collect some.

"The pupa of a species of *Eristalis* was found in the same place. The fly of the first worm sent you (identified by Baron Osten-Sacken as a species of *Ephydra*) was seen in great abundance on the pool at the bottom of the Graduation house. When alarmed they will fly up a few inches from the water, then alight upon it again in another place, and will glide about upon its surface with rapidity and the greatest ease. I think the worms come from a small egg, deposited by the fly, which sinks to the bottom of the water, where it is hatched, and the first visible stage of life is a very small white maggot, that crawls or rather wriggles about on the bottom until the pupa is matured; they then attach themselves by their abdominal appendages to sticks and roots and to one another, forming great knots or ropes. In this way they remain fixed until the fly is developed. I send you some of the small white maggots; you have already some of the pupæ and empty cases."

Similar flies had been observed living in salt vessels in the Graduation houses of the salt works in Saxony, Prussia; and it will be interesting to learn whether these species are peculiar to brine of the exact strength noted by Mr. Cox, or whether they can be detected elsewhere. He hoped the whole history of these singular insects would be unravelled during another season.

In this connection Dr. Packard stated that he had observed the metamorphosis of a gnat, (*Chironomus*) allied to the mosquito, which lives in the larva and pupa state on the floating eel-grass in Salem harbor.

Dr. Packard had also received a puparium found by Dr. T. D'Oremieulx of New York, in the sea-weed on the shores of Narragansett Bay, which is scarcely distinguishable from the puparia received from the salt works of Illinois. Dr. Packard had also collected the puparium of an *Ephydra*, at Square Island, Labrador, but it was undoubtedly found in a fresh-water or brackish-water lake, for the specimen slipped into his collecting bottle without attracting notice, but had it been found on the sea-shore it would have undoubtedly gained attention. It differs very slightly from the Illinois puparium, chiefly in the larger abdominal legs, or tubercles with hooks. Dr. Packard thought that these puparia probably belong to three distinct species of *Ephydra*, the pupa-cases themselves apparently not furnishing specific characters, as, so far as he knew, the cylindrical ones of *Anthomyia*, etc., do not.

Besides these two halophilous insects, the *Ephydra* of Narragansett Bay, and the *Chironomus* from Salem Harbor, there is only one other salt-water insect known in New England. Several years since, Dr. Packard found the larvæ of a species of *Mycralymna?* living in the green thread-like algæ at low-water mark in Casco Bay. Whether the larvæ, for they were common, feed upon the algæ, or are carnivorous, like most of the *Staphylinide*, was not observed.

February 5, 1868.

The President in the Chair. Forty-two members present.

Mr. Theodor Eulenstein of Canstatt near Stuttgart, Württemberg, was elected a Corresponding Member.

Dr. T. M. Brewer read a paper on the house sparrow of Europe, defending it from the supposed destructive habits recently attributed to it.

He showed that all the best English ornithologists are either silent as to its destructiveness or contend that the good it does very far exceeds the harm. He quoted from Bewick, Thompson, Selby, Mudie, Yarrell and Macgillivray, all of whom bear witness in favor of the great benefits the sparrow confers in the destruction of injurious insects.

He read an extract from the report of a commission to the Senate of France, furnishing very strong evidence in favor of the usefulness of the sparrow, showing that at all times, at least one-half of its food consists of insects, and at some times almost exclusively; that wherever the sparrows have been unwisely destroyed, injurious insects have immediately increased to such an extent as to become a calamity; destroying crops; and that in several countries the sparrows have been re-introduced and stringent laws passed for their protection; this had occurred in Hungary, Baden, and in different districts of France. One instance was cited to show that a single pair of sparrows have been known to destroy over seven hundred cockchafers in feeding one brood.

Dr. Brewer stated that the sparrows already introduced into New York, have accomplished wonders in the destruction of the measure worms in that city, and also in the neighboring cities. In the summer of 1867, it was stated the sparrows were seen actively at work all over New York, clearing the trees of these worms, and so successfully that the foliage of none was known to have been eaten. The sparrows are already regarded with great favor in New York, commodious thatched bird-houses having been constructed for them; in some of the parks they are regularly fed, and are great favorites with the children.

Great expectations have been formed in regard to the services they may render in this country, not only in keeping down the measure worm, but also in destroying canker worms, caterpillars, and possibly the curculio.

Mr. S. H. Scudder stated that he had purposed to watch the transformation of our grasshoppers, during the coming summer, to determine the relative rank of the families of Orthoptera. All entomologists, German as well as French, English and American, have placed the Forficulina (unless distinguished as a separate order) at the head of the group, the Blattina second, the Phasmidæ and Mantidæ third, the Gryllodea, Locustina and Acrydii last. Burmeister and De Haan have changed the order of the latter families, but the general arrangement remains the same.

Graber has recently published* some observations which bear directly upon the point, but he has drawn no deductions from them. His studies on the transformations of these insects lead him to divide them into two groups, the saltatorial and non-saltatorial orthoptera.

In the latter group, the first indication of wings in the young insect is a slight expansion of the outer hinder borders of the dorsum of the meso- and meta-notum; this grows larger with succeeding moults, and, just before the final moult, becomes an extensive lappet, which shows no sign of disruption from the segments; the veins of the future wing are already mapped out, but they are only horizontal dorsal extensions of the thoracic segments. In the former group the wings arise as little lappet-like vertical extensions of the pleura of the meso- and meta-notum, and are directed slightly backward; in a second or third period they become separated by a suture from the segments of which they are but prolongations, and in the succeeding stages the wings are bent over, separated clearly from their segments as proper appendages, and assume a dorsal, horizontal or roof-like position instead of their former lateral and vertical one. They have left the embryonic position retained by the other group through life, and have attained a higher one. The saltatorial orthoptera must then be placed above the other groups of orthoptera, contrary to the usage of all previous writers.

The Custodian announced the purchase of a large collection of birds, reptiles and insects, obtained by Dr. C. H. Van Patten during his residence in Guatemala.

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*Zur Entwickelungsgeschichte und Reproductionsfähigkeit der Orthopteren. Sitzungsb. der K. Akad. der Wissenschaften zu Wien; Math.-naturw. Classe; Band LV., 307.

February 19, 1868.

Vice President Dr. C. T. Jackson in the chair. Thirty-two members present.

Mr. Theodore Lyman exhibited an apparatus invented by Mr. Seth Green for hatching the spawn of the shad.

It consists of a box, so arranged with floats at the sides as to be slightly raised at one end; the bottom is made of wire-gauze, sixteen wires to the inch, upon which the eggs are placed. The box is anchored, with the raised end directed up the stream, and the water, which is deflected into it by the bevelled edge of a cross-bar, keeps the eggs in constant but easy motion. When the young are hatched, they are suffered to pass out through a wire netting of large meshes, ten wires to the inch, at the end of the box. This is done at night, when their natural enemies, the larger fish, leave them undisturbed. Unlike most of the fry of river fish, the young shad swim immediately to the deepest part of the stream, and are at once safe from their foes.

Mr. Lyman also exhibited a model of a fish-breeding establishment, and explained the manner of raising trout. As these fish will only deposit their spawn upon pebbly bottoms, the ponds in which they are kept are furnished with mud, while the artificial streams which feed the ponds are supplied with clean gravel. The breeder places boards over portions of these streams, and the shady places thus formed are sought by the fish in the breeding season. Here they are easily caught without disturbing the fish in the pond, and the spawn can be extracted at will.

Mr. Albert S. Bickmore read a paper describing his journey from Canton, through the interior of China, to Haukow, on the Yangtse.

He first passed through the delta of the Sikiang, whose broad, fertile banks support a most dense population. Mr. Bickmore thinks the continued fertility of these low lands can be accounted for in two ways: first, the Chinese are careful to save everything that can possibly serve as manure—in some places even to the hair they shave from their heads; and, secondly, these fields are subject, at least once a year, to floods, which cover them with a rich deposit of fine mud. At Wuchau, eighty miles up the Sikiang, Mr. Bickmore reached the last missionary outpost, and induced the missionary then visiting that city to accompany him up the Kweikong river to Kweilin, the capital of the province of Kwangsi.

These rivers are so dangerous on account of robbers that the Chinese boats never go up or down, excepting in large numbers. Mr. Bickmore passed a mandarin's boat that had been robbed the first night after leaving the capital. Smuggling is universally practiced, and the mandarin boats, which carry the officials and are not liable to be searched, improve every opportunity of avoiding the customs. The whole country from Wuchau to Kweilin, a distance of two hundred miles, is in a state of such complete anarchy that every village has its own fort, where all the rice and clothing not needed from day to day are stored for safety.

From Kweilin Mr. Bickmore continued northward down the Siang and Yangtse rivers to Haukow and Shanghai.

The object of this journey was to ascertain the nature of the rocks and their order of position in the region traversed. The lowest formation is *granite*, on which rests a second series of rocks composed of *grits* and *shales*. These, in turn, are covered by the third formation of *old limestones*, which Mr. Bickmore considers as probably belonging to the Devonian period. On them lie, fourthly, another series of *limestone* strata, which are probably later than the carboniferous, and may be of Triassic age. Mr. Bickmore found that water communication really exists between the Sikiang and the Yangtse river systems, so that a traveller, leaving Canton in the rainy season, can make a journey of two thousand miles through the interior, and reach the seacoast at Shanghai in one and the same boat.

Mr. H. Mann read a letter from Dr. Sturtevant, accompanying cones of the white pine which were found in a peat bog at Framingham. This bog was originally a small cove of water, shallow at the edge and deepening toward the centre. For about five feet the muck forms a compact deposit, showing no trace of structure ; it then becomes a mass of reddish vegetable fibre, with pine cones imbedded at the depth of three feet. Seeds of the pine are also found upon the upper surface of this vegetable deposit.

Dr. Charles T. Jackson presented two specimens of fossil or submarine guano, which he had recently received, from the plantation of Mr. Toomers, in the vicinity of Charleston, S. C.

The following chemical analysis proved it to be true guano:—

Water	5.00
Organic matter	2.34
Phosphate of lime (with a little phosphate of iron)	60.00
Carbonate of lime	10.00
Soda	2.66
Siliceous sand	20.00
	100.00

Separated by another analysis, there was found:—

Phosphoric acid	32.29
Lime	28.79

This fossil guano is filled with casts of shells, which appear to be *Terebratulæ* and is probably of tertiary age, but as yet no description of the geological character of the deposit has been received.

Section of Entomology. February 26, 1868.

Mr. B. P. Mann in the chair. Seven members present.

The Secretary read the following paper :—

ON THE STRUCTURE OF THE OVIPOSITOR, AND HOMOLOGOUS PARTS IN THE MALE INSECT. BY A. S. PACKARD, JR.

The rudiments of the ovipositor of *Bombus fervidus* appear before the larva has attained its full size, as in specimens whose tegument had been hardened by alcohol, the rudimental "rhabdites"—as Lacaze-Duthiers terms the elements of the ovipositor—could be faintly seen. When the larva is about full-grown, the three terminal segments (eight to ten) appear, as represented in Fig. 1. The broad, large sternites are separated by a well-marked suture from the pleurites. Just behind the middle of the eighth sternite, and at a little distance from the mesial line, are situated a pair of flattened tubercles,

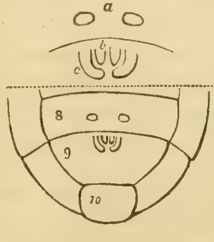


Fig. 1.

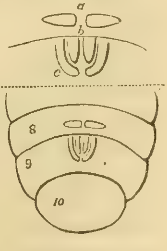
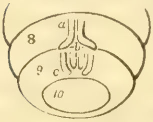


Fig. 2.

oblong-oval in form. These tubercles (Fig. 1, *a*) are the rudiments of the first pair of rhabdites. Just in front of the base of the ninth segment arise two pairs of tubercles, whose development is farther advanced than that of the first pair of rhabdites. The second or outer pair (*c*) are long and slender, and curved at right angles, so that their tips are placed in front of those of the third pair (*b*). These are triangular, with their bases nearly touching on the mesial line. Between the ends of the third pair is the external opening of the oviduct.

In a succeeding stage (Fig. 2), when the changes to the pupa state have begun, the first pair of rhabdites increase in length, but still retain their former position. The two other pairs lengthen out, especially the inner or third pair, while the outer pair are less curved.



No. 3.

In a farther advanced stage (Fig. 3) of the semi-pupa, the greatest change has occurred in the first pair of rhabdites which have greatly increased in length (the development of the others having remained more stationary), and now closely meet over the mesial line of the body, while their ends are pointed outwards nearly at right angles to their basal two-thirds. The insertion of the third pair (*b*) seems now to be set back, the first and third appearing as if arising from the eighth abdominal segment, as we incorrectly stated they were in these Proceedings, Vol. x, p. 281.

In the next stage (Fig. 4, front and side view), the eighth urite, or sternite, has been drawn within the abdominal cavity, and there become greatly aborted so that the three rhabdites appear as if they all took their origin from the ninth ring, as supposed by Lacaze-Duthiers, in his elaborate work on the Female Genital Armor. The eighth pleurites and tergum, however, still appear. The ninth are partially aborted, the tergal and pleural portions of the arthromere having, when seen from below, disappeared, the ovipositor resting upon the sternite. The tergal portion is much smaller, and seen from above is partially retracted beneath the eighth tergite. The seventh and tenth arthromeres are unchanged, the latter being, however, a little smaller.

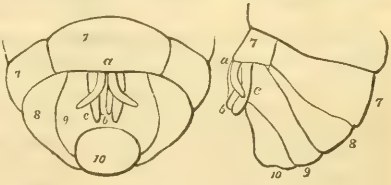


Fig. 4.

The first pair of rhabdites (or octo-rhabdites) still diverge at their tips, which reach to the outer third of the two other pairs. The ends of the second pair rest on the base of the tenth segment. In a lateral view (Fig. 4), the relation of the parts is better seen. The ovipositor, as the three pairs of rhabdites taken collectively may now be called, appears as if appended to the ninth urite.

In a succeeding stage (Fig. 5), the six rhabdites are very equal in size. The first pair diverge from their base, and, as seen in the side view, are laid over on each side of the other two and thus form a sort of sheath for the other two pairs. The second pair is the larger of the two, the true sting being formed by the union of the innermost and slenderer pair.

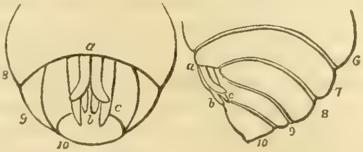


Fig. 5.

After this the three pairs unite more closely, and are retracted gradually within the abdominal cavity (See these Proceedings, Vol. x., p. 295, figs. 3 and 4) until in the mature pupa they are entirely concealed.

The corresponding parts in the male (Fig. 6, *B. vagans*) consist of three pairs of tubercle-like outgrowths from the urites of the ninth ring. There are two very unequal pairs of fleshy tubercles situated parallel to each other on the hind edge of the ninth ring. The outer pair (*z*) are large and rudely conical. The inner pair (*y*) are linear oval, and arranged antero-posteriorly upon the mesial line of the body. Immediately in front is the anterior pair of tubercles (*x*), which are a little shorter and broader than the mesial pair, but which together form an inverted Λ, of which the apex rests over the suture, between the eighth and ninth rings, while the posterior ends diverge outwards, abutting upon the external pair of tubercles. Upon looking at these parts in the pupa, the tubercles exposed in the semi-pupa are seen to be merely the extremities of much longer parts which are concealed beneath the crust in that stage. Whether these parts are present in the larva, as the homologous parts are in the female, as is most probable, I have not specimens of male larvæ to enable me to decide. All the parts taken together are situated in a triangular area. The lining of the termination of the intestine, which is drawn out when the larva skin is removed, shows the position of the anal orifice in relation to the genital armor. It opens just above the inner pair of linear tubercles.

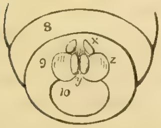


Fig. 6.

The genital armor of the male pupa in the natural position appears, when seen from beneath, as two pairs of tubercles, situated between the last abdominal ring and the eighth urite, occupying a transversely oblong area, when before it was triangular, owing to the absence of the Λ-shaped pair of tubercles, which are now concealed from view. The eighth urite, still more triangular and pointed, covers them in. The mesial parallel pair are much changed in form, since they are each curved outwards, and diverge at both extremities like an X. Upon pulling the whole apparatus, with the neighboring rings, out like the section of a telescope, we find that it has greatly increased in size, and that it has become wholly separated from the rest of the abdomen, being attached by its integuments, and that the V-shaped parts of the tubercle are obsolete. The base is partially covered above by the obtusely triangular tergite, and below by a thin, square, lamellate, finely setose urite. The bases of the outer larger pair of hook-like organs are inclosed in the remnants of the ninth ring. It is short, complete above, but becomes obsolete beneath. The outer hooks, or rhabdites, are three times as long as broad, and consist of two portions; one basal, and the other terminal, and provided with several hooks. At their bases they approach each other very closely, only a slight fissure intervening; then they suddenly narrow towards the middle, and continue of the same width to the end; both sides are parallel and curve inwards so much that the tips are near to each other, by a distance equal to the breadth of either of the pieces. The terminal piece which, in reality, is nearly square, consists of two portions separated by an oblique suture, of which the outer piece is the smaller, and terminates in a sharp slender hooklet, bent inwards itself, and placed on the inner side, next the hooks of the inner and middle pairs of organs.

The inner pair of hooklets, which are long, slender, and curved inwards and downwards, arise parallel to the base of the outer portion of the outer pair of hooks. The basal portion to which they are attached are united to form an oval fleshy piece, which is apparently thrust out from between the outer pair of hooks.

Viewed from beneath, the outer pair of hooks are smaller and shorter, in form more triangular, with more acute and incurved tips, which inclose a broader interspace. The outer portion of the hook described above, does not appear on the lower side. On the contrary there is a deep suture beneath it, and thus there is another longer piece which forms a hook-like prolongation on the under side of the basal piece.

In the young of *Æschna* and *Agrion* the development of the ovipositor seems to be much the same. In the pupa of *Æschna*, the first pair (*a*) of rhabdites arise from the eighth urite (Fig. 7), and the two other pairs, arising from the ninth urite, are closely appressed to the body, the tips of the outer (*c*) of the two pairs being free.

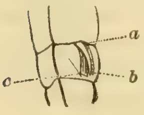


Fig. 7.

In the pupa (Figs. 8, 8*a*, enlarged) of another species of *Æschna*, though of the same age as the other, the wing-pads being of the same size, the male genitals can be seen. There are no appearances of any tubercle, or any marking whatever, indicating their presence on the eighth ring, but on the ninth there are two pairs of flattened tubercles; the inner pair being regular oblong-oval, the outer orbicular, and much larger. These are to form the male intromittent organs, so considered by Burmeister, while the organs at the base of the abdomen are, as stated by authors, probably organs of excitement.

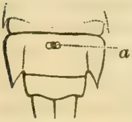


Fig. 8.

Fig. 8, *a*.

In the larva of *Agrion* the ovipositor (Fig. 9, front and side view; 8, 9, 10, 11 represent the four terminal segments of the abdomen; *d* one of the three false gills, *e* a supplementary style) is nearly identical with that of the larva and semi-pupa of *Bombus*. As seen in the figure, the rhabdites are large and blade-like. The ovipositor is so far developed that the origin of the first pair (*a*) is seen to be just under the posterior end of the eighth urite, and by analogy it seems right to assume that, in an earlier condition of the insect, it arises from the surface of the eighth urite, as we have seen above in the *Bombus* larva. Seen sideways, the first pair of rhabdites are laid between the outer pair (*c*) of the succeeding urite, and do not ensheath them as in *Bombus*. In *Æschna* (as in *Bombus*), the first rhabdites ensheath the two other pairs; and in the pupa of *Agrion* this may be the case.

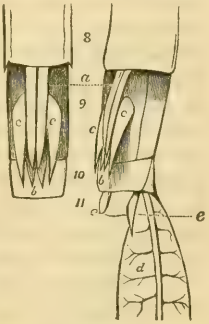


Fig. 9.

The accompanying figure (10), reduced from a drawing of Lacaze-Duthiers, gives a theoretical section of the abdomen, showing the relative position of the outlet of the alimentary canal (R) and the oviduct (O), in relation to the ovipositor. *a* represents the "lateral scale," or one half of the outer sheath, and *a′* its valvular part; *e* the support of the stylets, or second pair of rhabdites (*i*); and *f* the sting, with *d*, its support.

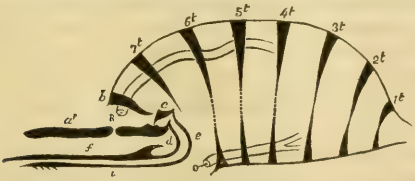


Fig. 10.

We do not here attempt to study the structure of the ovipositor in the adult, referring the reader to the great work of Lacaze-Duthier's, where the complicated structure of these parts is copiously illustrated by drawings and descriptions. The learned entomologist, however, only refers to the ovipositor, not describing the homologous parts in the male; nor does he trace their development in the young.

From the observations presented above it appears, that Lacaze-Duthiers's conclusion, that the three elements (rhabdites) of the ovipositor grow from the ninth abdominal segment alone, is incorrect; the first pair, according to our observations, arising from the eighth; the oviduct, as he states, opening on the ninth urite.

We have seen that these rhabdites, as Lacaze-Duthiers aptly terms them, are developed from the *abdominal sterna*, and not from the *pleural, or limb-bearing, region* of the body. So far as present observation goes these rhabdites are never jointed. We should naturally endeavor to find their homologues in the head of insects; but such homologues do not seem to exist. The labrum and clypeus, and probably the lingua, are *single* parts, developed immediately upon the median line, the two former being probably tergites, and not dividing into pairs; while the rhabdites are double organs, and seem to be unique in their development and function. They are morphologically pre-anal organs; while the *anal stylets*, which are true jointed appendages, are post-anal appendages, being developed *behind* the anal opening. Regarding the insect as consisting of two fore and hind halves, the two ends being, with this view, repetitions of each other, these anal stylets may be considered as abdominal antennæ, so that the antennæ look one way, and their homologues, the many-jointed antenniform anal stylet (Fig. 11. The antenniform anal stylet of *Mantis tessellata*, after Lacaze-Duthiers), the opposite.

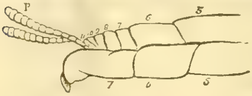


Fig. 11.

These abdominal antennæ, or feelers (being appendages of the 11th abdominal segment), must not be confounded with the ovipositor, as in the highest insects, the *Hymenoptera* and *Lepidoptera*, they are, so far as known to us, not present at all, though one distinguishing mark of the former suborder is the sting, or when this is functionally absent, the variously modified ovipositor.

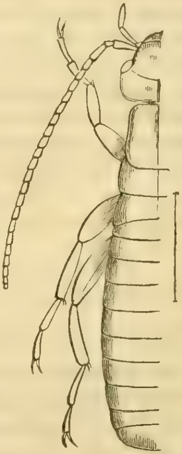
The presence of the anal stylet should be considered as a mark of inferiority, as it is best developed in the lowest insects, the *Orthoptera* and *Neuroptera*, and in the order of *Myriapods*. The researches of Rathke and Claparède show that the three pairs of abdominal jointed limbs which form the "spinnerets" in spiders, are developed, like the cephalic and thoracic members, from the pleural or limb-bearing region, and are homologous with the single pair of anal stylets of insects, and the abdominal legs of *Myriapoda*.

In Plate IV., Fig. 37, of Claparède's *Recherches sur l'Évolution des Araignées*, are represented the rudiments of six pairs of abdominal limbs, three pairs of which are deciduous; the three remaining pairs apparently forming the spinnerets. It should be noticed that in Fig. 33, only four pairs of abdominal limbs are shown. The two other pairs, together with the segments to which they are attached, are developed in the region between the post-abdomen, or terminal lobe, and the basal portion of the abdomen.

ON A WINGLESS WHITE ANT FROM JAPAN. BY DR. H. HAGEN.

I beg to lay before the Section a new orthopterous insect, belonging to the family of *Termitina*, from the alcoholic collection of the Museum of Comparative Zoölogy at Cambridge. I found only one specimen in a bottle with other insects from Japan. They were collected by Mr. Gulick.

Its very strange form reminded me at first of a Coleopterous larva, or an abnormal *Forficula*, but I was much more interested in finding that the animal belonged to the *Termitina*. As yet no species has been described from Japan; nevertheless, the occurrence there was proved a long time ago by Këmpfer and others. After a closer examination, I find that the species is the very strangest *Termes* yet known.



The animal, named by me *Hodotermes Japonicus*, belongs probably to a new genus, but having only one specimen, it is prudent to postpone the creation of a new genus. *Hodotermes Japonicus* is nearly fifteen millimetres long, above flat, polished, black, beneath brown. Its form is of equal breadth, three to three and one-half millimetres. The abdomen above has very small and sparsely scattered, flat, golden hairs. The antennæ have twenty-four articulations, the first and third joint longer and cylindrical; palpi as in *Termes*; ocelli none; prothorax flat, quadrangular; mesothorax tranversely oblong with its hinder border straight, with no traces of a wing-case. Metathorax similar to the mesothorax, but the hinder border broadly excised. Abdomen very long, with corneous flat segments, the ninth a little shorter. The apex is broad, but is damaged in the specimen. The venter has eight segments, the last large, ovoid, as in the female *Termes*. The appendices are very short, conic, bi-articulated or broken. The form of the legs is extraordinary; they are shorter than the abdomen, and nearly as long as the tibia; its basal joint two-thirds of the length robust, the tarsus of the tibia, its apical joint one-third, without plantula between the two claws. With the microscope I think I find between these two joints, two others, very small, certainly one; the second and apical is doubtful. The place of the species in the family of *Termitina* is apparently near *Hodotermes*, which has no ocelli, and the first joint of the tarsus longer than the others, but not so long as in this specimen.

But to which sex or state does the animal belong? This question is most interesting. Its corneous, dark colored teguments exclude the idea that it is a larva or nympha; the equally enlarged thorax excludes the laborer, the ordinary form of the mandibles, the soldier. It would be very good as an imago, but no trace of wings or wing-cases exists. Lespès mentioned among the *Termes* forms with short wing-cases in *T. lucifugus*, and I have done the same in *Calotermes flavicollis.* These forms are very little known, and the assertion of Lespès, that the king and the queen are raised from this state, is very doubtful. I think that these forms are similar to the short-winged examples in other Orthoptera, *Blattina*, *Psocina*, *Perlina*. But *Hodotermes Japonicus* has not the least trace of the existence of wings or wing-cases. It is impossible to say more without further materials. But it is possible that *Termitina* exist without wings in the imago state, as among the *Psocina*, and that *Hodotermes Japonicus* belongs to such *Termitina*.

The Secretary read a letter from Mr. G. Lincecum of Texas, describing the ravages of grasshoppers in that State.

Last spring the young were hatched from the egg in the early days of March; by the middle of the month they had destroyed half the vegetation, although the insects were wingless and not larger than a housefly. The first winged specimens were seen high in the air at about three in the afternoon; as a light northerly breeze sprang up, millions dropped to the earth, covering the ground in an hour, and destroying every green thing with avidity. During the night they were quiet, but at daybreak commenced to eat, and continued until ten in the morning, when they all flew southward. At about three o'clock on the afternoon of the same day another swarm arrived, ten times greater than the last: these took flight the following day; and so they continued, coming and going, day after day, devouring the foliage and then depositing their eggs. At first they selected bare spots for this purpose, but finally the whole surface of the earth was so broken up by their borings that every inch of ground centained several patches of eggs. This visitation was spread over many hundreds of miles.

Mr. S. H. Scudder stated that he had recently received a collection of butterflies made by Mr. J. A. Allen, in Iowa; there were forty-six species in all, three of which were new.

One, *Chrysophanus Dione*, was of about the same size as the *C. Thoe;* the sexes were nearly alike in their markings; the upper surface was of a grayish brown, with faint violet reflections; the primaries had two black spots in the cell, and the hind margin of the secondaries was bordered somewhat as in *C. Thoe;* beneath, the coloration and markings were similar to those of *C. Thoe*, but the spots on the secondaries were differently arranged. The second species, an *Apatura*, for which the specific name *Proserpina* was proposed, differed from the species of this genus hitherto found in the United States, in having well rounded hind wings. The coloration agreed in general with that of *A. Clyton*, but the markings were more diffused, the spots more indistinct, and the insect itself much larger, expanding two and two-thirds inches. The third species, *Hesperia Iowa*, differed from *H. Delaware* Edw. in having duller colors, a much broader margin, and a longitudinal streak along the middle of the cell in the primaries of the female.

Mr. Scudder also exhibited two fossil insects from the coal measures.

One was found in the iron-stone nodules of Morris, Illinois, which have previously afforded remains of insects. The fragment represents the wing—apparently an upper one—of a neuropterous insect, which he called *Megathentomum pustulatum.* It is gigantic in size, very broad, with distant nervures, simple and slight divarications, and in the outer half of the wing, which alone is preserved, a cross neuration, composed of most delicate and irregular veinlets. The wing is also furnished with a large number of larger and smaller discolored spots, the surfaces of the larger ones irregularly elevated.

The *vena mediastina* is simple and straight; the *vena scapularis* sends out two branches from its upper side, the first of which does not reach the border but loses itself in a congeries of minute veins, while the second, branching again quite near its origin, supports the tip of the wing; the *vena externo-media* occupies the middle third of the wing, and divides once near the base; each branch is straight and forks again, the upper one a little nearer the border than the second divarication of the *vena scapularis*, the lower still nearer to the margin; the *vena interno-media* divides several times, the uppermost branches forking again just inside of the border; the *vena analis* does not appear on the fragment.

There are six larger round or squarish spots; four of them form a bent row a little beyond the middle of the wing, the upper three spots being nearly straight and the lower one turned inward at a little more than a right angle; the uppermost spot occurs in the interspace between the *venæ scapularis* and *externo-media*; the others follow in succeeding interspaces. The two other large spots are found in the same interspaces with the upper two of the inner row, and are situated about half way between them and the border. The smaller spots appear to be less regularly distributed; they are usually round, but sometimes oval or elongated; there are three at equal distances from each other in the lower outer interspace formed by the branches, of the *vena scapularis*, one occurs just within and above the inner of the three just mentioned, and one near the angle of the last divarication of the *vena scapularis*; there are two between the forks of the upper branch of the same and, in the interspace between the branches one spot is found close to the margin; two larger and elongated spots occur in the same interspace with the lowest of the four large spots and three equidistant round ones in the next interspace below; in the succeeding interspace, probably about half way between the base and the outer border, there is an oval spot; finally two faint ones are situated upon and beneath each of the branches of the *vena externo-media* near the middle of the wing.

The wing was probably a little more than three inches in length; its greatest breadth measured by a line at right angles to the costal border is 1.8 inch; from the apex of the wing, where the upper branch of the *vena scapularis* touches it, to the lowest point of the lower outer angle 2.1 inches; from the centre of the upper, inner large spot to the outer margin 1.05 inches; greatest breadth of an interspace, .34 inches. This insect, apparently allied to the *Coniopterygidæ* by the simplicity of its neuration, differs from that family, not only in the cross-veining, but in the mode of branching and the proportion of the wing allotted to each of the veins. Dr. Hagen has shown me in this wing some resemblances to the *Phryganidæ*, but I am inclined to believe it is distinct in its family characteristics from any known type of Neuroptera.

The second insect, for which the name of *Archegogryllus priscus* is proposed, was found by Dr. J. S. Newberry in the lowest coal beds at Tallmadge, Ohio. It consists of a broken leg of a cricket and a very small fragment of its wing—apparently a lower one. There are no determinate characters in the wing. The leg was broken into fragments from which a femur and tibia could be made out; they are quite remarkable, for while the femur is smooth, the tibia is furnished with several prominences of large size; in modern types, the prominences, if they occur at all, are found only on the femur; in this specimen there is a slight rounded prominence on the upper surface at the very base of the tibia and another just beyond the middle; opposite the latter, on the upper surface, is a deeply bifid elevation, its hollow corresponding to the elevation on the upper surface; the basal half of the under surface is occupied by a very broad prominence, abrupt at its edges, of nearly equal height throughout, but slightly depressed in the middle. Length of the femur, .28 inches; breadth of the same, .11 inches; length of the tibia, .26 inches; breadth of the same, .045 inches.

March 4, 1868.

Vice President, Mr. T. T. Bouvé, in the chair. Thirty-nine members present.

Mr. Albert S. Bickmore read a paper on the Ainos, or hairy men of Yesso, Saghalien and the Kurile Islands.

In the spring of 1867, Mr. Bickmore passed through Hakodadi on his way from Yedo to the mouth of the Amoor river. Crossing the Japan sea to the coast of Manchuria, he continued up the Gulf of Tartary to Saghalien, meeting the Ainos both here and at Hakodadi. He describes them as about five feet high, with large heads and long black hair and beards. Their features resemble so essentially those of the Caucasians that Mr. Bickmore does not hesitate to remove them from the Turanian family, where they have been hitherto placed, and refer them to the Indo-European or Aryan family. Ethnologists in London and Berlin have since coincided with this view. These people are peaceable, generous and affectionate; they have no written characters—not even the picture language of the ancient inhabitants of Mexico and Peru; the nearest approach to anything of the kind is the practice of the old men at Saghalien who communicate with each other by means of sticks peculiarly notched. They do not cultivate the soil, but subsist chiefly by fishing; they use poisoned arrows in hunting, and consider it the height of bravery to kill a bear; the skulls of these animals are placed on tall sticks near their houses; twenty-nine were counted in front of a single dwelling in Yesso.

The Ainos are mentioned in Japanese history more than 2500 years ago. Mr. Bickmore thinks that starting from Central Asia, they followed the northern borders of the Mongolian desert to the head waters of the Amoor, and either continued down that river to Saghalien or through the peninsula of Corea to the Japanese islands. They once occupied the whole of the large island of Nippon, but, after many centuries of continued warfare with the Japanese, were driven northward over Tsugar straits to the island of Yesso. They now occupy Yesso, the southern part of Saghalien and all the Kurile islands. They are undoubtedly passing away, and if the nations of the Western World had reached this remote region a few centuries later, the Ainos would have been known to us only by a few passages in the historical writings of their cruel oppressors, the Japanese.

Dr. C. Pickering remarked that the conclusions of Mr. Bickmore in regard to the affinities of the Ainos were fully sustained by the photographs exhibited.

Mr. E. S. Morse called attention to the mode of growth of a new entomostracous Crustacean which he had found in this vicinity. The concentric lines of increase upon its carapace greatly resemble those of a bivalve shell. These markings, so unusual in a crustacean, led him to make a microscopical examination of the shell; he found that the lines were the margins of the exuviations, which, instead of being discarded—as almost universally occurs among crustaceans—were cemented together and retained upon the animal. Although this mode of growth resembles that of the bivalve Mollusks, it does not actually depart from the crustacean type of moulting. The species, which he called *Limnadia americana*, is the first ever discovered on this continent; a few others occur in Mauritius, St. Domingo, France, and Russia.

The Custodian announced a valuable donation of an extensive series of humming birds and nests, and of West Indian shells, from Mrs. Henry Bryant, for which the thanks of the Society were voted.

The Vice-President announced that a second course of weekly lectures—eight in number—on Structural Botany, would be given by Mr. Horace Mann, in the Society's Museum, commencing on the afternoon of the following Saturday.

March 18, 1868.

The President in the chair. Forty-four members present.

The following paper was read:—

THE ANGORA GOAT; ITS ORIGIN, CULTURE AND PRODUCTS. BY JOHN L. HAYES, SECRETARY OF THE NATIONAL ASSOCIATION OF WOOL MANUFACTURERS.

The Jardin des Plantes, the source and model of our Societies of Natural History, gave to the world not only Buffon and Cuvier, who, by their brilliant labors, won for the researches of the naturalist a place in the domain of science, before accorded only to studies of the imponderable elements, but two other scarcely less illustrious naturalists, whose labors were inspired by the purpose of applying their favorite science to increase the material resources of man. To this idea France owes the Merino sheep with which Daubenton endowed her, and the Imperial Society of Acclimatation, the creation of Geoffroy St. Hilaire, which aims to submit to practical study all the animals by whose acquisition the geographical zone of France can be advantageously augmented. Trusting that this Society may regard with favor the discussion of a subject akin to those which have received the attention of the great practical naturalists of France, I propose to submit a memoir upon the Angora Goat, the last acquisition which our agriculture and manufacturers have received from the animal kingdom.

When we reflect that of the numerous species which compose the animal kingdom, forty-three only are at the command of man, and that the only lanigerous animal extensively appropriated in this country, besides its product of food, has furnished in a single year, from domestic sources, seventy per cent. of the raw material for a manufacture valued at over one hundred and twenty millions of dollars, we must regard the acquisition of a new animal producing food and material for clothing, as an epoch in the industrial history of the country. It is the peculiar province of a Society like this to aid the development of this new national resource by shedding the fullest light upon the specific and geographical source of this animal, upon its habits, food and diseases, the uses of its products, and, above all, upon the laws which govern its reproduction; in a word, to make upon this subject natural history *applied*. As my object is less to present original matter than to diffuse the best authenticated information, corrected by your criticism, or sanctioned by your approval, a work rendered necessary by the errors abounding in agricultural reports and publications, I shall avail myself of the memoirs of M. Brandt, M. Tchihatcheff, M. Sacc, and M. Boulier, naturalists of high repute, and the very numerous notices scattered through the proceedings of the Imperial Society of Acclimatation.

The description of this animal, given in 1855, by M. Brandt, director of the Museum at St. Petersburg, and distinguished among the zoölogists of Europe, for his conscientious work and profound knowledge, is as follows:

"The magnificent example of the Angora goat, which the Museum of the Imperial Academy owes to M. Tchihatcheff, produces at first sight the general impression of a domestic goat, when attention is not directed to its thick and silky fleece, to its flat ears turned downwards, and its inconsiderable size. But it is precisely these traits which impress upon this animal a distinct seal, which give it the character of a peculiar race, whose origin is perhaps not the same as that of the domestic goat. The extremity of the snout, the cheeks, the nasal and frontal bone, as well as the ears, and lower part of the legs below the tarsal articulation, are covered with external hairs, which are shorter and thicker than those which cover the above mentioned parts in other species of goats. The forehead has soft hairs of less length, less applied to the skin, and, in part, curled. The hair of the beard, which is pointed and of moderate dimensions, being six inches in length,* is stiffer than the hair of the rest of the body, but less so than that of the beard of the ordinary goat. The horns, of a greyish white tint, are longer than the head; at their lower part the interior marginal border turns inwards in such a manner that in this part they appear broad viewed in front, and narrow when seen exteriorly; at half their extension they direct themselves moderately backwards, and turn spirally outwards, so that their extremities directed slightly upwards, are very much separated one from the other, and circumscribe a space gradually contracting itself. The whole of the neck, as well as the trunk, is covered with long hairs, which, particularly upon the neck and lateral parts of the body, are twisted in spirals having the appearance of loosened ringlets, it being observed at the same time that they reunite themselves into rolled tufts, a disposition which is less marked in the anterior part of the neck. The hairs which exhibit the greatest length are situated above the forelegs, and are almost nine and one-half inches long. Those of the neck are a little shorter and are nine inches long, and those of the belly eight inches three lines. The length of the hair with which the lateral parts of the body, as well as the back, are covered, is only seven inches six lines, and that of the hair of the hind legs six inches to seven inches. Finally the slightly stiff hair of the tail is about four inches in length. The color of the robe of the animal is a pure white, here and there slightly inclining to yellow. The hoofs, somewhat small in proportion, are, like the horns, of a greyish white tint. The hair is without exception long, soft and fine; it is at once silky and greasy to the touch, and shows distinctly the brilliancy of silk."

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* All the dimensions given by M. Brandt are in German measurement. One German foot is equal to 1.0299 English feet.

M. Brandt observes that the hairs corresponding most to external hair have only a third, or at most, do not attain half the thickness of the external hair of the common goat ; and that the external hair of the wild and domestic goats is not only closer, stiffer, and more massive, but has a more considerable torsion and a less even surface, that is to say, it is rougher and more scaly. He also remarks that "the walls of the hair of the Angora goat being thinner than those of the hair of the common goat, the substance contained in the fatty cellules oozes out more readily, which renders the hair of the Angora goat softer and more flexible, and gives it the lustre of silk."

M. Brandt omits to mention that the long ringlets cover the hair, properly called, which is rough and short and lies sparingly upon the skin.

The dimensions of the specimen examined by M. Brandt are given by him as follows:*

	ft.	*in.*	*l.*
From the point of the snout to the root of the tail . . .	4	4	2
Length of head		11	9
From the point of the snout to the eye		5	1
From the eye to the ear		2	5
From the eye to the horns		1	9
Length of ear		6	0
Length of horns in direct diameter	1	2	0
Length of horns following the curvature	1	6	6
Distance between horns taken at their roots		2	1
Distances between their terminal points	1	9	9
Width of horns at their roots		2	1
Length of tail, including the hair		9	9
Height of anterior part of the body	2	2	4
Height of posterior part of the body	2	2	2

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* Bulletin de la Société Impériale d'Acclimatation. T. II., pp. 316–18.

The point of inquiry most strictly pertinent to the objects of this Society and one at the same time eminently practical, as indicating the laws which govern the reproduction of this animal, thus illustrating the relations of pure science with utilitarian ends, is the determination of the specific source of the Angora goat.

The popular opinion as to the origin of this species is founded upon the authority of Cuvier, who mentions but three species of the genus *Capra—Capra agragus*, *Capra ibex*, *Capra caucasica.* He says, "*Capra ægragus* appears to be the stock of all the varieties of domestic goat;" adding that they vary infinitely in size and color, in the length and fineness of the hair, in the size of the horns, and even in the number; the Angora goats of Cappadocia having the largest and most silky hair.*

The more recent researches of zoölogists have greatly developed the knowledge of this genus. Instead of three only there are now recognized nine species of wild goats, which are divided into two groups based upon the form of the horns:—

1. Group with horns flat in front, having a horizontal triangular section, and furnished with large transversal knots.	Capra ibex. Capra hispanica. Capra pyrenaica. Capra caucasica. Capra sibirica. Capra Walei. Capra Beden.
2. Group with horns compressed and carinated in front.	Capra Falconeri. Capra ægragus.†

NOTE.—THE CASHMERE GOAT. The only goat beside the Angora which is strictly lanigerous is the Cashmere or Thibetian goat, which abounds in Central Asia, but whose origin is still obscure; although it has, according to Brandt, affinities with the Angora race. The size of the Cashmere goat is quite large; the horns are flattened, straight and black, and slightly divergent at the extremities. The ears are large, flat, and pendant. The primary hair, which is long, silky and lustrous, is divided upon the back, and falls down upon the flanks in wavy masses. Beneath this hair there is developed in the autumn a short and exceedingly fine wool, from which the famous Cashmere shawls are fabricated. The enormous prices of these shawls when extensively introduced into France at the commencement of the present century, as high as ten or twelve thousand francs, stimulated the French fabricants to emulate the Indian tissues. The first yarns from Cashmere wool were spun in 1815, and the high numbers were worth eight dollars per pound. The peculiar Indian texture called "Espouline" was perfectly achieved; and the success in this manufacture was hailed as the most brilliant triumph of the textile industry of France. Under the patronage of Monsieur, afterwards Charles X., in 1819 a great number of these goats were imported from Thibet, as many as four hundred being introduced by one manufacturer, Baron Ternaux, and much enthusiasm was excited in their culture. Experience, however, proved that these goats yielded but very little milk, and that the raw wool or down produced from an individual never exceeded one hundred and eighty grammes, usually much less, which it was very difficult to separate from the coarse hairs, "yarre," and yielded not more than twenty-five per cent. of material which could be woven. The manufacturers also discovered, although they had overcome all the mechanical difficulties of fabrication, that the raw material, expensive as it was, formed not more than one-tenth of the cost of a shawl; that the Indian weaver worked for one-fifth the wages of a French workman, and that the ladies of fashion would pay double price for an Indian shawl, inferior in color, design and texture to the French fabric. The manufacture, which employed four thousand workmen in 1834, began to decline in 1840; and, although an occasional fabric may still be made, the manufacture has now ceased as a regular industry. The demand for the wool ceasing, the Cashmere goats became absorbed in the common race; and there is at present but a single flock of pure blood in Europe, the one preserved in the remarkable collection of domestic animals possessed by the King of Wurtemburg. There is reason to believe that the culture of the Cashmere goat will never be revived in Europe as a matter of profit, since a perfect substitute for the Cashmere down is found in the silky fleece of the new Mauchamps sheep, which is declared to be fully as brilliant and fully as soft as the product of the Cashmere goat, while it costs less as a raw material, and requires less manipulation to be transformed into yarn. (Sacc, sur les chèvres. Bulletin supr. cit., T. IV., p. 48. Industrie des châles. Travaux de la Commission Français, p. 10. Berneville Industrie des laines Peignées, p. 161.)

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* Animal Kingdom, Mc Murtrie's Translation. Vol. I., p. 198.

† Essai sur les chèvres par M. Sacc. Bulletin supr. cit., T. III., p. 519, 561, T. IV., p. 3. Giebel.

The so-called goat of the Rocky Mountains is removed by Professor Baird from the genus *Capra*, where it was formerly placed by him under the designation of *Capra Americana*, mountain goat. He says in the description of *Aplocerus montanus*, contained in his Report of the Zoölogy of the Pacific Railroad routes, "The figures and description of the skull and other bones of this species by Dr. Richardson, show very clearly that the affinities are much more with the antelopes than with the goats or sheep. In fact, none of the more modern systematic writers place it in the genus *Capra*, or, indeed, in the ovine group. The mere general resemblance, externally, to a goat is a matter of little consequence; indeed, its body is much more like that of a merino sheep. The soft, silvery, under hairs are very different from those of a goat, as well as the jet black horns, which are without any ridges, and smooth and highly polished at the extremities."*

The more recent investigations have shown that the animals referred to, and figured by G. Cuvier and F. Cuvier as types of the *Capra ægragus* or Paseng, and said to occur both in Persia and on the Alps, were domestic goats which had become wild. Later researches have determined the true characteristics of *C. ægragus*, a species formed by Pallas from a cranium only, received by Gmelin from the mountains of the north of Persia, and have shown that naturalists had adopted this species as the source of the domestic goat without resting the assertion upon any proof. The comparison by M. Brandt in 1848 of a collection of skulls and horns obtained by M. Tchihatcheff in the Cappadocian Taurus, with the original cranium which served Pallas for the type of his species, has enabled that naturalist, for the first time, to demonstrate positively the derivation of our domestic goat from *Capra ægragus.* M. Brandt asserts that it results from his labors that this species "is incontestably and exclusively the source of the domestic goat of Europe" and gives the following arguments in support of this assertion:—

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* Vol. VII., p. 672.

1. "The *Capra ægragus* has all the exterior forms and all the proportions of the domestic goat."

2. "It resembles it very much in the general as well as local distribution of its colors."

3. "It approaches the domestic goat more than any other species in the configuration of its horns, a configuration which plays so important a part in the characteristics of the wild species."

4. "It presents the same agreement with the domestic goat in respect to the cranium. Finally, it is found in the mountains of the countries, especially Mesopotamia, inhabited by the people of antiquity, (the Israelites, Assyrians, etc.,) which have furnished the most ancient information respecting the raising of the goat."*

The establishment of the perfect identity of the domestic goat with a wild species is a negative argument of much force for the exclusion from the same source of an animal so widely differing as the Angora goat. A positive argument of equal weight is the recent observation that the Angora goat more nearly resembles another wild species lately discovered. This species, the *Capra Falconeri*, is found upon all the mountains of Little Thibet, and upon the high mountains situated between the Indus, the Badukshan and the Indo Kusch. It resembles greatly the domestic goat, from which it differs principally in its magnificent horns, which, near together at the base, are at first arched backwards, and then turn in a spiral inwards, and then over again outwards. They are strongly compressed, triangular and free from knots; their internal face, at first plane, is rounded higher up, whilst their external face is everywhere convex. Although there does not appear to be a development of fleece in this wild species corresponding to that of the Angora goat, M. Sacc, professor in the faculty of sciences at Neuchatel, who has made a special study of the goats, does not hesitate to declare, that "all the characters of this species seem to indicate that it is the source of the beautiful and precious Angora goat whose horns are spirally turned like those of Falconer's goat." M. Brandt intimates that the domestication of other wild species than *C. ægragus* and perhaps the *C. Falconeri* had produced the Angora goat. Geoffroy St. Hilaire, the highest authority upon the origin of domestic animals, refers to the opinions of M. Sacc and M. Brandt without dissent, thus: "he (M. Brandt) is led especially to see in the Angora goat, produced, according to Pallas, by the cross of the sheep with the goat, an issue of the *Capra Falconeri*; this opinion is also admitted by our learned confrere, M. Sacc." *

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* Considerations sur la Capra ægragus de Pallas, souche de la Chèvre domestique par. J. F. Brandt. Bulletin supr. cit., T. II., p. 565.

The hypothesis that the Angora goat is descended from Falconer's goat is rendered probable by the diffusion of the former around the mountains of Thibet, where Falconer's goat abounds, and even beyond the central plains of Asia from Armenia to Chinese Tartary, where its wool is manufactured, or exported in a natural state by the port of Shanghae. Angora wool, or mohair, was exhibited at the London Exhibition of 1862 among the Russian products, as proceeding from the country of the Kalmucks of the Don, situated between the Black and Caspian Seas. This species is thus seen to be diffused, although it may be sparingly, over the whole surface of Asia.

That this goat is at present more abundant in the country about Angora in Asia Minor, near the habitat of the *Capra ægragus* and distant many thousand miles from Thibet, may seem opposed to its derivation from the Thibetian species. The learned memoir of the Russian traveller, M. Tchihatcheff, † establishes beyond question the comparatively recent introduction of the Angora goat into Asia Minor. He has shown that among the countries of classic antiquity there is no one which the ancient writers have mentioned more frequently and under more varied aspects than Asia Minor, because this country was not only one of the foci of the Greek civilization, but also the native country of a great number of the most celebrated writers of antiquity, such as Herodotus, Homer, Strabo, Dion of Halicarnassus, Galen, etc. Hence in all that concerns the natural history of Asia Minor, the writings of these authors have an especial interest, while their silence has the value of a negative argument. Referring to the writings anterior to the classic period, we find in the most ancient and venerable of historic monuments, the Bible, that the goat is frequently mentioned among the domestic animals which constituted the riches of the first patriarchs. Yet there is nothing in these notices which leads us to suppose that they were possessed of a race with fine and white wool. The beautiful comparison in the Song of Solomon which might seem to suggest the existence of a choice race of these animals, "Thy hair is as a flock of goats that appear from Mount Gilead" taken in connection with the verse following, "Thy teeth are like a flock of sheep that are shorn, which come up from the washing," would seem to intimate that the color was referred to by the poet as the point of resemblance; while the first comparison, to be flattering to youthful beauty, must imply that the color was black and not white.

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* Sur les origines des animaux domestiques. Bulletin supr. cit., T. VI., p. 503.

† Considerations sur la chèvre d'Angora. Bulletin supr. cit., T. II., p. 411.

Coming down to the Greek authors,—Homer and Hesiod, though frequently mentioning the goat as a domestic animal, make no allusion to any particular race. Ælian, referring to the goats of Lycia and the practice of shearing them like sheep, says that the wool is used for cords and cables. Appian mentions the stuffs known under the name of *κιλίκια* from Cilicia, the ancient name of the country in which Angora is situated, as a means of protection against projectiles; implying that the tissue of the goats of Cilicia were not distinguished for their fineness. Virgil gives the wool of the goat no other destination than to serve for the necessities of the camp and for the use of poor sailors :—

"*Usum in castrorum et miseris velamina nautis.*"

Columella, the great writer on Roman agriculture, quotes this line of Virgil as applicable to the covering of goats, and while tracing the qualities which a perfect animal should possess, excludes all resemblance to the Angora goat by demanding that the hair should be black. Strabo, born in the town of Amasia, very near the present domain of the Angora goat, makes no mention of goats of that country distinguished for their fleeces, although he remarks upon the different races of fine wooled sheep found in many places in Asia Minor. The author whom I am following observes that the most careful research among the Byzantine writers, after the Roman possessions became the patrimony of a barbarous people, has not afforded the least indication of a fine and white wooled goat. It was not until the year 1555, that the Angora goat was distinctly made known through the Father Belon, who had travelled in Asia Minor, by a brief but sufficiently characteristic description. The silence of the classic authors in respect to any goat with fine and white fleece would seem to place it beyond doubt that the progenitors of this animal were introduced into Asia Minor at a comparatively recent period, when the country was invaded by barbarous and pastoral races, either Turks or Arabs. M. Tchihatcheff observes that the Arabs have never formed stable establishments in Asia Minor, while the Turkish race is the only one among the modern invaders of that country which came in search of a permanent home and has preferred it unto this day. He shows that two branches of the Turkish race, the Suldjeks and the Oghus, successively installed themselves in Asia Minor in the eleventh and thirteenth centuries, taking possession of the precise region in which Angora is included, and which their descendants still occupy. Immediately previous to their immigration they had occupied the vast plains of Khorassan and Bokara, and still more anciently, according to the most celebrated orientalists and geographers, the country on the southern borders of Siberia and the mountains of the Altai chain. It appears thus to be not improbable that a race of animals, originating in Central Asia, whose representative still exists in the *Capra Falconeri*, should have been carried by the migration of pastoral tribes to the region in which they are now found in the modified form of the Angora goat. This hypothesis is supported by the statement of the President de la Tour d'Aigues, probably derived from the Turkish shepherds who accompanied the flock introduced by him into Europe in 1787, that "there is a constant tradition that the goats of Angora did not originate in that country, but were derived from Central Asia." *

Although the origin of the Angora goat from Falconer's goat is not demonstrated by proofs as positive as those which support the derivation of the common goat from *Capra ægragus*, they are not less positive than those which formerly led all naturalists to attribute the paternity of the common goat to that species. The absolute knowledge of the progenitor of the Angora goat is of less practical importance than the demonstration of a specific difference between the two races. That the Angora goat constitutes a particular race, and is not due to the same origin as the common goat, seems established by the following considerations:—

1. There is an essential difference in the horns of the two races, those of the Angora race being twisted spirally, a configuration wholly wanting in the common race, the form of the horns being recognized by modern systematic writers as the basis of the classification of the family *Cavicornia*, or ruminants with horns permanent, hollow and enclosing a piece of the frontal bone.

2. The mammillary organs are hemispherical, while they are elongated in the common species.

3. The very long wooly hair hanging in corkscrew ringlets, fine, white and lustrous as silk, covering the short and harsh hair properly so called, which lies upon the skin, is in striking contrast with the short and coarser external hair of the common goat with its finer interior hair or down.

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* Sacc, Essai sur les Chèvres. Bulletin supr. cit., T. IV., p. 6.

4. The cry, wholly different from that of the common goat, resembles that of sheep.

5. The milk is more fatty ; the odor of the male less strong and disagreeable.

6. The Angora, unlike the common goat, is fattened as readily as the sheep, and the flesh is exceedingly palatable.

7. The specific difference is finally established by the character of the crosses, a point to be referred to hereafter with more detail.

The theory of the difference of species in these two races is not invalidated by the fertility of the products of their crosses; such fertility having been observed in the mixed offspring of the more widely separated species, the horse and the ass. In this case it is well established that the he mule can generate and the she mule produce, such cases occurring in Spain and Italy, and more frequently in the West Indies and New Holland.*

The practical deduction to be drawn from the separation of the two species is thus clearly stated by M. Sace. "There is then no utility in creating flocks of the Angora for crossing with the ordinary goat. We must limit ourselves to preserving the species in entire purity and devote ourselves to improving the race by itself as has been done with the justly celebrated merinos of Rambouillet."† A leading object of this paper is to enforce the opinion of this sagacious and practical naturalist.

Upon the introduction of the Angora goat into France in 1787, and more recently in 1855, the opinion was generally entertained that the principal benefit to be derived from the new race would result from the amelioration of the products of the common species. This opinion unfortunately prevails in this country. It is sanctioned by all the agricultural notices or essays which have been published respecting the new race, and is naturally fostered by importers and breeders to enhance the selling price of bucks.

One of the earliest papers descriptive of this species which appeared in this country was published in the Patent Office Agricultural report for 1857,‡ it being the abstract of a report upon the Cashmere goats, as they were called, in the possession of Mr. Richard Peters, of Atlanta, Georgia, written by the well-known naturalist, Dr. John Bachman, of Charleston, S. C. This excellent naturalist, repeating the views at that time generally entertained, says: "The varieties of goats are equally numerous and equally varied in different countries. They are all of one species, the varieties mixing and multiplying into each other *ad infinitum.* They all claim as their origin the common goat, *Capra hircus*, which it is admitted by nearly all reliable naturalists derives its parentage from the wild goat, *Capra ægragus*, that still exists on the European Alps." After referring to the diversity of color, aspect and form, seen in the goats of Hindostan, Chinese Tartary and Thibet, he says, "in a word, they are all of one species, but under many varieties; breeds have become permanent, and some are infinitely more valuable than others." He gives the results of breeding the Angora with the common goat as shown in the flocks of Mr. Peters in the following language:—"Familiar as we have been through a long life, with the changes produced by crosses among varieties of domestic animals and poultry, there is one trait in these goats which is more strongly developed than in any other variety that we have ever known. We allude to the facility with which the young, of the cross between the male of the Asiatic goat and the female of the common goat assume all the characteristics of the former. It is exceedingly difficult to change a breed that has become permanent, in any of our domestic varieties, whether it be that of horses, cattle, sheep or hogs, into another variety by aid of the male of the latter. There is a tendency to run back into their original varieties. Hence the objection to mixed breeds. But in the progeny of these Asiatic and common goats, nine-tenths of them exhibit the strongest tendency to adopt the characteristics of the male, and to elevate themselves into the higher and nobler grade, as if ashamed of their coarse, dingy hair, and musky aromatics, and desirous of washing out the odorous perfume and putting on the white livery of the more respectable race." Speaking of the Angora goat, Mr. Israel S. Diehl, who has contributed a paper upon it of much research, and valuable for many original observations, says:* "This goat, though described as the *Capra Angorensis*, is only an improved variety of the *Capra hircus* or common domestic goat." He refers to numerous State agricultural societies and scientific and practical men to show the value of the Angora goat and its fleece, "and the facility with which it can be crossed and bred with the common goat, by which a flock can be readily raised and increased," adding, "almost all the progeny exhibit the strongest tendencies to the higher and nobler grades by assimilating themselves to the male and putting on the white livery of the more respectable, honored, and valued race." These views widely circulated through the Government agricultural reports have been accepted without question, and the efforts of breeders in this country have been largely wasted in vain efforts to produce crosses which would have all the value of the pure race.

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* Lyell's Principles of Geology. Vol. II., p. 4 3

† Bull. supr. cit., T. v., p. 571.

‡ p. 56.

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* Report of the Department of Agriculture for 1863, p. 216.

To judge of the value and feasibility of such attempts we must bear distinctly in view the precise economical result to be sought for. It is obviously, not primarily to obtain a breed of goats which shall be fit for the butcher. Neither is it to secure a breed which will furnish a merely tolerable fleece which would be simply a substitute for the wool of the sheep. The object is to appropriate a race of animals which shall produce a textile material adapted for certain defined purposes in the arts as distinct as silk, noble Saxony wool, or sea island cotton; a material which is a substitute for nothing else known, and has originated its own fabrics. The introduction of a race which fails to give this peculiar fibre, would be no real acquisition, however amusing to the breeder, and interesting to the physiologist the experiments in crossing might be.*

Laying aside the statements given in the agricultural reports, as of little value as testimony, because there is no matter in which even skillful flock breeders are so liable to be deceived, as in the character and adaptation of their fleeces, and because there is no evidence that the products of the crosses referred to have ever been subjected to the only conclusive test, that of spinning, let us consider the feasibility of producing the typical fleece of the Angora goat, by means of crosses, by reference to admitted physiological principles, and the results in analogous cases. The illustrious naturalist, M. de Quatrefages, who has recently discussed, in his lectures at the Muséum d' Histoire naturelle, and in the Revue des Deux Mondes,† the principles which govern the formation of races, remarks that "there is one law in crossing which is constantly verified; each of the two authors tends to transmit to the product at the same time all its qualities good or bad." This tendency he admits is modified by the predominance in one or the other, of the power of transmissibility. "When this power is equal in the two parents the product will have an equal mixture of the qualities of the parents ; there will be a predominance of the qualities of one where this power of transmissibility is unequal. The inequality of the power of transmissibility appears to be much greater when the races are nearest each other, for sometimes the crossing between such races gives a product which seems to be-

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*The conviction is extending among intelligent wool growers in this country of the importance of preserving the varieties of woolly fibre, each in its own character, purity and excellence, and free from that "mongrel type which will *do* for everything but is *not desirable* for anything." At a meeting of the Ohio Wool Growers Convention, January 7, 1867, "Mr. R. M. Montgomery moved that the true course in breeding sheep is to keep breeds entirely distinct and to endeavor to produce the best clothing or the best combing wools, which proposition was unanimously agreed to." U. S. Economist, January 25, 1868.

† Vide Revue des Deux Mondes, December 15, 1860 to April 14, 1861.

long entirely to one of the two."* He observes that it follows from these principles that nothing could be more irrational than to take animals of the half blood as regenerators to ameliorate a race; for not possessing completely the qualities which we seek, and having preserved a part of the bad which we wish to shun, they transmit a mixture of one, and besides, as they are necessarily of a formation more recent than the race to be regenerated, it will be the last one which will impress itself, if not upon the first, at least upon successive generations. These views are confirmed by the recent observations of Professor Agassiz, in Brazil, on the effects of crosses of races of men He observes that the principal result at which he has arrived from the study of the mixture of human races in the region of Brazil is that "races bear themselves towards each other as all distinct species; that is to say, that the hybrids which spring from the crossing of men of different races are always a mixture of the two primitive types and never the simple reproduction of the characters of one or the other progenitor. It is also remarked by the same high authority, that, "however naturalists may differ respecting the origin of species, there is at least one point in which they agree, namely, that the offspring from two so-called different species is a being intermediate between them, showing the peculiar features of both parents, but resembling neither so closely as to be mistaken for a pure representative of the one or other."†

The views of the eminent physiologists above quoted give no support to the popular fallacy into which Dr. Bachman and Mr. Diehl seem to have fallen, that the male animal possesses the greater power of transmitting blood to his progeny. Dr. Randall in the chapter upon the principles of breeding in his "Practical Shepherd" while admitting that the ram much oftenest gives the leading characteristics of form, attributes the greater power of the ram to the superiority of blood and superiority of individual vigor, as the ram is generally "higher bred" than the ewes, even in full blood flocks.‡

If it be true as a physiological principle that the parents in widely separated races tend equally to transmit all their qualities, what hope is there of obtaining a valuable lanigerous animal from the crosses of goats so widely separated as to belong to different species; especially when the heavy coating of one is absolutely worthless, and nothing short of the peculiar qualities found in the other is worth seeking for? All analogy teaches that it is vain to expect to form a permanent race of any value from the crosses of such widely separated races. Dr. Randall declares that "all attempts to form permanent intermediate varieties of value by crosses between the merino and any family of the mutton sheep with the view of combining the special excellencies of each have ended in utter failure."* The German breeders say that it is *impossible* to transform, by crossing, the common sheep into merinos. Even after nine generations the common type reappears as soon as the use of merino rams of the pure blood has ceased.† It is for this reason that the Germans refuse to the highest bred grade any other designation than improved *half* breeds.‡

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* Amclioration de l'espécé chevaline, Bull. supr. cit., T. VIII, 1861, p. 257.

† A Journey in Brazil, by Professor and Mrs. L. Agassiz. pp. 296 and 338.

‡ pp.110, 111.

The constant use of regenerators of pure blooded Angoras, if they could be procured, which would soon be impossible, from domestic sources, if the system of crossing should be persisted in, would be of little avail. In the Asiatic goat we have a perfect standard, as in the Arabian horse. Mr. Youatt says of the English races of the horse descended from the Godolphin Arabian, or the Darley Arabian and the blood mares of Charles I., "where one drop of common blood has mingled with the pure stream, it has been immediately detected in the inferiority of form and deficiency of bottom."§ So, we may infer, will a drop of blood of the common goat detract from the lustre and fineness of fibre found in the pure Asiatic race.

The elaborate article of Mr. Fleischman on German fine wool husbandry‖ gives the results of constantly regenerating by the pure merino ram, the cross from the pure merino and common country sheep. At the fourth generation the fleece consists of 25 per cent. *prima*, 50 per cent. *secunda*, and 25 per cent. *tertia* wool. The nature of the wool is still coarse. There are about eighteen thousand wool hairs in a square inch. In the tenth generation the fine wool predominates. A fleece yields from 60 to 70 per cent. *prima*, 20 to 25 per cent. *secunda*, and 10 to 15 per cent. *tertia* wool. In the twentieth generation the fleece, by regular crossing and careful management, has 20 per cent. *electa*, 50 per cent. *prima*, 20 per cent. *secunda* and 10 per cent. *tertia* wool. There will yet be sometimes found *stickel* or coarse hair. At this period twenty-seven thousand wool hairs grow upon a square inch. Thus even at the twentieth generation, with the constant use of regenerators of the pure blood, the wool falls short of the fineness of the original or perfectly pure blooded animal, which has from forty thousand to forty-eight thousand wool hairs on a square inch. These facts show how slow is the approach to fineness of fibre even in crosses of animals descended from a remote though common ancestor.

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* The Practical Shepherd. p. 125.

† Sacc. Bull. supr. cit., T. v., p. 571.

‡ Practical Shepherd. p. 127.

§ Youatt on the Horse.

‖ Patent Office Report. 1847. p. 253.

Proceeding from analogy to direct evidence as to the results of breeding the race under consideration by means of crossing with the common species, no person in Europe has examined the Angora goat so thoroughly and for so long a period as M. de la Tour d'Aigues, President of the Royal Society of Agriculture of France, who in 1787 introduced some hundreds of these goats into Europe under the care of Turkish shepherds, and established them upon the low Alps where they greatly prospered. He affirms that even after the sixteenth generation the hair of the crosses obtained by crossing the Angora buck with females of the common goat remained hair and although it was elongated it could not be spun.* "This species is," he says, "constant; and although they procreate with our goats we can never hope to multiply them by crossing the races, because the vice of the mother is never effaced. If some individuals approach, more or less, the race of the sire, the hair will always be shorter and too coarse to be worked." † The testimony of this official head of the agriculture of France is of the highest value, not only because his position led him to seek the utmost advantage from the introduction of a new race, but because an elaborate memoir published by him shows that he had made thorough experiments in spinning and manufacturing the products of his fleeces, for which he gives minute directions.

The observations of M. Brandt show that the thickness of the hair of the pure Angora goat is from a third to a half that of the common goat. This fineness of fibre is an essential spinning quality. The fibre of this species is always prepared and spun in the form of worsted of long wool, that is, the fibre is not carded or subjected to a process by which the fibres are placed in every possible direction in relation to each other, adhering by their serratures, but are drawn out by combing so that they may be straight and parallel, the ends of the fibre being covered in the process of spinning, so that the yarns are smooth and lustrous. The fibres being extremely slippery they will not adhere in spinning unless they have the requisite fineness to permit many parallel fibres to be united in a yarn of a given number. When the fibres are too large they require to be mixed with combing wool to "carry" the fibre, as it is technically called, which diminishes the lustre of the fabric. Manufacturers of worsted, who have had large experience in spinning the mohair of Asia and this country, inform me that the best mohair can be spun into yarns of the number forty-two, while others are with difficulty spun into yarns numbered from ten to sixteen. Fibre of the latter quality is of no more value than the most ordinary combing wool, except for a few exceptional purposes to be hereafter referred to. Lots of so-called Angora wool, doubtless the products of recent crosses, offered in the market the present season, could be used only for carpet filling, the lowest use of woolly fibre.

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* Sacc, Bull. supr. cit., T. v., p. 570.

† Idem T. IV., p. 8.

Although the facts and reasoning given above leave no doubt upon my own mind that the breeding from crossings of the common goat of this country should be abandoned, it is proper that I should state that hopes are still entertained in France of good results from breeding with the domestic goats of that country. M. Richard, of Cantal, in a report made in 1862 upon the animals deposited by the Society of Acclimatation at the farm of the Souliard in the Cantal, says: "Crosses produced from the Angora and the ordinary goats of Auvergne have given products, which at the second generation much resemble those of pure blood; and if the Society should continue its experiments upon this subject, I think it will obtain some happy results. Nevertheless, to settle the opinion upon this point, it would be useful to study this practical question wherever the Angora goats have been deposited."* The most that can be made of the opinion so cautiously expressed is that the system of crossing is still regarded in France as a proper subject of experiment.

CULTURE IN THE REGION OF ANGORA.

The culture of this species in the country of its greatest development next demands attention. Ample information upon this point is furnished by scientific travellers. The celebrated academician Tournefort, the master in botany of the illustrious Linnæus, was the first to shed full light upon the ancient magnificence of Ancyra, the site of the present Angora, mentioned by Livy among the illustrious cities of the East. He refers to its most ancient people as having made even the Kings of Syria their tributaries, while its later inhabitants were the principal Galatians, whom the Apostle Paul honored with an epistle. He describes its monument to Augustus, the most splendid in all Asia, upon which was inscribed in pure Latin the life of the Emperor, its streets abounding with pillars and old marbles mingled with porphyries and jaspers, its walls built up of ruins of architraves, bases and capitals, and its tombs covered with Greek and Latin inscriptions, all attesting that this was one of the centres of the Roman civilization, and making more significant the silence of contemporary authors before alluded to. But more interesting than the monuments of past splendors, is the mention first given with any detail by this traveller, of the contribution to modern civilization made by the barbarians from Central Asia. I transcribe his language :

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* Bulletin supr. cit., T. IX., p. 8.

"They breed the finest goats in the world in the champaign of Angora. They are of a dazzling white, and their hair, which is fine as silk, naturally curled in locks of eight or nine inches long, is worked up into the finest stuffs, especially camlet. But they do not suffer these fleeces to be exported from this place because the people of the country gain their livelihood thereby. . . . . . However it be, these fine goats are to be seen only within four or five days' journey of Angora and Beibazar. Their young degenerate if they are carried further. The thread made of this goat's hair is sold for from four livres to twelve or fifteen livres the ocque. Some is sold for twenty and five and twenty crowns the ocque, but that is only made up into camlet for the use of the Sultan's seraglio. The workmen of Angora use this thread of goats' hair without any mixture, whereas at Brussels they are obliged to mix thread made of wool, for what reason I know not. In England they use up this hair in their periwigs, but it cannot be spun. . . . . . All this country is dry and bare, except the orchards. The goats eat nothing except the young shoots of herbs, and perhaps it is this which, as Brusbequius observes, contributes to the consummation of the beauty of their fleece, which is lost when they change their climate and pasture."*

Interesting statements in relation to the culture of this species at Angora are given by Capt. Conelly, an English traveller, in a paper read before the Asiatic Society, which I deem it unnecessary to repeat, as they are generally accessible in Mr. Southey's work on wool.† The most recent information is that given by the Russian traveller before quoted, who devoted five years to the study of natural history in Asia Minor, and M. Boulier (Pharmacien Aide Major) in a report of a mission to Asia Minor presented to the French Minister of War.‡ The region marked out by the former of these scientific travellers, as the peculiar domain of the Angora goat, is situated between 39° 20′ and 41° 30′ north latitude, and between 33° 20′ and 35° longitude east of Paris, a surface of about 2350 metric leagues square, equivalent to about a forty-fourth part of the surface of the peninsula of Asia Minor, and about the same fraction of the area of France. This country is more or less mountainous and furrowed by deep valleys, its mean altitude being estimated at 1200 metres, while the more elevated masses are generally shaded with fine forests; the plateaus which form a large part of the country, are very little wooded. The absence of trees, bushes and arborescent plants gives the country the aspect of immense steppes. This nudity permits the first heats of the spring to dry up the little humidity which the earth has acquired in winter. The climate is excessive, the winters being very cold, and the summers exceedingly hot. The country is covered with snow in winter, the rain and snow being very frequent, the thermometer in the neighborhood of Angora frequently descending to 12°, 15° and 18° of the centigrade thermometer, corresponding to 53.6°, 59° and 64.4° Fahrenheit.

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*A Voyage into the Levant. By M. Tournefort, Chief Botanist to the French King.

†Southey on Colonial Wools. p. 322, et seq.

‡Vide Considérations sur la chèvre d'Angora par M. P. de Tchihatcheff, Bull. supr. cit., T. xi. p. 395. Sur la chèvre d'Angora. Par M Boulier, Pharmacien Aide Major. Bull. supr. cit., T. iv., p. 557.

The cold season continues, however, only three or four months. During the rest of the year the temperature is very hot, particularly in the valleys, while the fine days continue almost without interruption; abundant pasturage is found for the white goats only after the frosts and snows, when the first warm rains revive the vegetation. This time is of short duration, and the stimulus given by a copious and succulent nourishment is exerted wholly in developing the fleeces in length. The shearing, which takes place in April, is hardly concluded when the vegetation called forth by the warm spring is arrested, and receives no moisture from the dews, persons lying at night in the open air finding in the morning no humidity upon their garments. This dryness, however, gives to the vegetation which flourishes, the only aliment to flocks during summer, an aromatic character which makes it peculiarly digestible and stimulating.

The mineralogical character of the rocks which underlie the country is generally feldspathic, the trachytic and serpentine rocks abounding. No peculiar mineralogical elements appear to be essential to the successful culture of this species, as M. Boulier observes that there is not the least sign of degeneracy in the fleeces of flocks grown upon calcareous or gypseous soils. The localization of this species in certain districts within the general domain assigned to it, is quite remarkable, and appears to be mainly determined by the altitude of the country, the flocks of the pure race being rarely distributed upon the most elevated districts, in the deep valleys or the neighborhood of the forests. This localization is doubtless encouraged by the native proprietors, who unanimously assert that this goat cannot be transported from the place where it is born to a neighboring village without suffering a deterioration of fleece. Even the intelligent travellers above referred to seem to partake of this opinion. Direct observations, however, in Europe and elsewhere, have shown that this apparent deterioration is only the effect of age, and not due to a change of place and climate or food. The finest fleece is found upon animals a year old, which is worth eleven francs the kilogramme ; although somewhat less fine in the second year, it is quite good at the end of the fourth year, when it is worth six francs the kilogramme.

At the end of the sixth year the fleece is positively bad, and at this period the animals are usually killed, their natural life being only nine or ten years.

All authors agree that these animals, although able to resist both heat and cold except immediately after shearing, when they are liable to be destroyed by moderate depression of temperature, cannot withstand much humidity, either in their pastures or folds. In a moist atmosphere they are especially subject to maladies of the respiratory organs, or a kind of pleuro-pneumonia. In severe winters, while the common goat of the country is unaffected, the mortality among the goats of the pure race is frightful. This is due largely to their confinement, when the temperature is 15° centigrade, in very bad stables completely closed and unventilated, and to their nourishment upon fodder imperfectly dried, a very little barley only being given when the snow falls. The delicacy and lymphatic temperament of the white Angoras, which seem to be inherent to this race, appear to be closely related to their color. Some physiologists see in the color and delicacy of this animal the evidence of an imperfect albinism. In the very interesting discussions of the Board of Agriculture of Massachusetts in 1867, many curious facts were stated, illustrating the relation of a white color in animals with certain diseases and deficiences; for instance, that white horses are subject to diseases to which black or red horses are not. Prof. Agassiz expressed the opinion "that change of color in animals must be the result of some general change in the system, and if it is not shown in the eyes it will be shown in something else, the light color being a kind of bleaching of those darker tints which are connected with the qualities of the blood, indicating a certain feebleness of the system." These views are peculiarly interesting when taken in connection with the facts stated by M. Boulier as to the manner in which the losses above referred to are repaired. The fact had already been stated by M. Tchihatcheff, that when the losses are very considerable, the people of the country repair them by crossing the Angora with the common goats, and that the purity of the race is regained in the third generation. This statement was regarded in France as conclusive as to the expediency of crossing with the common goat of France, until the statements which follow were published. M. Boulier shows that the goats referred to as common in Asia, are of the same species as those of the pure Angora race from which they differ only in their color and size. The variety which is spread everywhere in Asia Minor upon all soils and at all altitudes, is the black or Kurd race. The variety confined to the narrow limit is the *white* race. "The one and the other," he says, "have long fleeces. Their general forms resemble each other. The black goat is only of a size about a fifth larger than the white goat. The weight of the fleeces of the black race varies between three and four oeques (3 kil. 750 to 5 kil.). The hair, black, straight and without undulation reaches a length of 0.27 m. . . . The length of the locks of the white race reach 0.25 m. and the weight of the best fleeces two oeques (2 kil. 500)." M. Boulier cites two examples to show that the introduction of the white female goats into the country where they have not previously existed is not regarded by the natives as the most simple and rapid means of acquiring the more precious race. "Seventy years ago, at Zehiftela Gentchibe Yallaci, the natives possessed no white goats. Since that period they have crossed the black female goats of the village with the buck of the white race, and at present there are not less than eight thousand goats of the latter race, upon the territory of that district. We have examined the flocks, and the fleeces are in no respect inferior to any of those which we have seen elsewhere. It is now established in respect to these new generations that after three years of experience the newly crossed race has not degenerated; it is distinctly established, since for a long time the regenerators are taken from the flocks themselves. At Sidi Ghazi the crossing by the same procedure has been commenced within only six years. The flocks are magnificent." The effects of the crossing in the successive generations are thus detailed:—

"1. The cross of a black female goat with a white buck will present a fleece marbled with a yellow color upon an impure white foundation. The flanks, the shoulders and the head will preserve more particularly the marks of the color of the mother; the fineness of the fleece will be sensibly ameliorated.

2. The cross of this first product with a white buck will cause all the dark tints to disappear. The fleece will become white. The shoulders and the flanks will be covered with wavy ringlets; but the whole line of the back, and the forehead will remain furnished with coarse, straight hairs.

3. On coupling this new cross always with a buck of the pure race we shall obtain a greater fineness in the long ringlets of the flanks and shoulders; the dorso-lumbar portion of the vertebral column will no longer retain coarse hairs which will remain still on the upper part of the neck and forehead.

4. A fourth cross, carried on with the same precautions as before, will fix a stamp of purity to the product: the coarse hairs will have disappeared on the forehead and neck.

5. The consecutive crossings will render more stable the modifications already formed, and already after the fifth generation the indi-

viduals will be able to reproduce as if they were of the pure blood."*

An infallible proof of fineness not mentioned by M. Boulier is insisted upon by other writers, viz., the curling of the wool, which is observed upon the young individuals only when they are of the pure blood, so that all the young bucks are rejected from the flocks with the utmost care as not being of the pure race, whose wool is not curled.

It is not to be denied that further observations are greatly to be desired in confirmation of the observation of M. Boulier. They are, however, referred to by M. Sace as both "skillful and conscientious" and are relied upon by the latter naturalist as establishing the identity of the species of the black Kurd and white Angora race, and they are quoted with approbation by M. Bemis, principal veterinary surgeon of the army of Africa. This identity seems confirmed by the observations of M. Diehl, who has personally visited Angora. "There is also a second, or other variety of Angora or shawl wool goat, besides those generally described. This goat has an unchanging outer cover of long coarse hair, between the roots of which comes in winter an undercoat of downy wool that is naturally thrown off in spring or is carefully combed out for use. A remarkably fine species of this breed exists throughout the area to which the white-haired goat is limited."

The number of goats of the white race grown in the district of Angora is estimated by M. Sace and others at three hundred thousand, and the product in wool called tiftik by the natives, and mohair in England, at two million pounds. The English tables of Turkish exports make the product in 1867 a little over four million pounds. Formerly the wools of Angora were wholly spun or woven in place, and were exported in the form of yarns or camlets, of which the city of Angora sold in 1844, thirty-five thousand pieces to Europe. The exportation of the wool was prohibited through the same wise policy which enabled England by its monopoly of the combing wools to build up its stupendous worsted manufacture. Some twelve hundred looms were employed. The natives displayed great skill in making gloves, hosiery and camlets for exportation, and summer robes of great beauty for the Turkish grandees.† The town flourished and the whole population was busy and happy in the pursuit of their beautiful industry. After the Greek revolution the Turkish Government was tempted by British influence to admit, free of duty, the products of European machinery and to permit the export of the raw tiftik. This fatal step was the death blow of the town of Angora. The whole product, with the exception of twenty thousand pounds only, still worked up at home, was exported to England. The looms employed were reduced from one thousand two hundred to not more than fifty; and the town, although having at its command the raw material for a most important and characteristic manufacture, offers in its sad decline another monument of the desolating influence of that system which would make the raw material of every country tributary to the one great workshop of the world.

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* Bull. supr. cit., T. v., p. 168. The facts stated by M. Boulier may seem inconsistent with the views elsewhere presented in this article as to the slowness of improvement by crossing. The identity of species in the black and white race is not settled by this naturalist. The power of deviation within wide limits may be a characteristic of this species in domesticating; and these facts, to use the language of Prof. Agassiz in relation to deviations of species, may "only point out the range of flexibility in types which in their essence are invariable." A Journey in Brazil. p. 42.

† Southey on Colonial Wools.

RESULTS OF EXPERIMENTS IN ACCLIMATION IN EUROPE AND THE UNITED STATES.

The attention of philanthropic agriculturists in Europe was drawn to this race in the last century. The first attempt to appropriate the race in Europe was made by the Spanish Government, which imported a flock in 1765, which has disappeared. Next followed the importation of the President Tour d'Aigues, who introduced some hundred upon the Low Alps in 1787. This experiment of acclimation appears to have been wholly successful, as this eminent agriculturist declares that although his flocks received no special care, they were constantly preserved in good health and accommodated themselves as well to the climate as the pasturage. "I can attest," he says, "that nothing is easier than to raise and nourish the species; they are led to the pastures with the sheep and are fed like them in winter." Towards the end of the last century Louis XVI. imported a flock of Angoras, to Rambouilet, but this, as well as the flocks of Tour d'Aigues, disappeared in consequence of the revolution. The best results were obtained in Spain from the importation of a flock of a hundred in 1830 by the King of Spain. M. Graells reports that this flock was transported to the mountains of the Escurial where he says: "I had occasion to see them for the first time in 1848, that is to say, eighteen years after their entry into Castile. At this time the flock was composed of two hundred individuals, almost all white. The males had a magnificent fleece. The shepherds told me that all the primitive individuals had disappeared, and that those which lived were born in the country, and that they could be regarded as naturalized to the climate, the food and other inherent conditions of the central region of Spain. At Huelva there is another flock of Angora goats, composed of a hundred head, and from the information

I have obtained it prospers very well in the mountainous region of that province."* The above extract is instructive as showing the slowness with which this race is multiplied, the primitive flock having tripled only in eighteen years.

In 1854, the Imperial Society of Acclimation of France resolved upon vigorous efforts to appropriate this race. In 1855, it was in possession of a flock of ninety-two head. This flock was subdivided and placed in different districts in France. But the success was far from encouraging. Many died, and those which survived gave fleeces which were far from satisfactory. In 1858, all the separate flocks were reunited and placed at Souliard in the mountainous and trachytic district of the Cantal. The animals rapidly recovered their health, and were increased without suffering any malady. The fleeces were in an admirable condition, and were fabricated into velvets of such fineness and lustre that it was pronounced that "the wool of the Angora goat has been ameliorated in France." The increase of this flock was disastrously checked by the rigorous winter of 1859, and the rainy and damp summer which succeeded. "The abundant snows of the winter," says M. Richard, "prevented on the one hand the goats from issuing from their stable; the stabulation favored in them a predominance of the lymphatic system. On the other hand the showers and the incessant rains of the spring continued during the whole summer. The goats, always in a damp atmosphere, eating wet grass, contracted as well as the sheep an aqueous cachexy; a third of the animals succumbed from this malady. If energetic means had not been employed upon the first symptom of the invasion of the affection which was decimating the flock, it is very probable that few would have survived. The malady was arrested by a tonic and fortifying medication." The flock, reduced from ninety-two head in 1855 to seventy in 1862, was at the latter period in good health.†

The experience in France, although by no means encouraging in all respects, is instructive as indicating the principal cause of the destruction of the flocks, exposure to a damp climate. The excessive climate of the middle and northern districts of this country, the cold winters and warm dry summers would seem to indicate these districts as most favorable to the acclimation of this species. Experience has fully confirmed what might have been assumed *a priori*. The first importation was made in 1849, by Dr. J. B. Davis, of eight Angora goats, two bucks and six females. The facts relative to subsequent importations and their results are given in the elaborate article of

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* Rapport de M. Ramen de la Sagra. Bull. supr. cit., T. I., p. 23.

† Sur les animaux de la Société d'Acclimatation. Par M. Richard (du Cantal). T. IX., p. 5.

Mr. Diehl, which, being readily accessible in the widely circulated Agricultural Report of 1863, I need only briefly refer to. Mr. Diehl gives the results of his observations of most of the flocks, proceeding from some three hundred head imported from Angora, numbering, according to him, several thousand, and scattered mainly through the southwestern States, as follows:

"We have either personally visited and examined most of the localities and flocks (mentioned by him), seen or obtained animals or specimens of the wool, comparing them with what we saw abroad and the best specimens of wool to be obtained from abroad, or the best imported ones, and are well satisfied and thoroughly convinced that we have succeeded, and can continue to succeed, in raising this valuable wool-bearing animal, with its precious fleece, almost anywhere throughout our country where sheep will prosper, especially in the higher and colder localities,—producing an animal more hardy, with a heavy and more valuable fleece than the Angora or Cashmere itself in its own country. The specimens of wool in our possession are more silky and fleecy than the imported or original ones." M. Diehl gives extracts from original communications of practical stock raisers confirmatory of his statements. It is to be regretted that the value of these observations is diminished by the want of accurate discrimination between the products of the crosses and animals of pure blood.

APPLICATION OF PRODUCTS.

It has been already stated that mohair is not a substitute for wool, but that it occupies its own place in the textile fabrics. It has the aspect, feel and lustre of silk without its suppleness. It differs materially from wool in the want of the felting quality, so that the stuffs made of it, have the fibres distinctly separated and are always brilliant. They do not retain the dust or spots, and are thus particularly valuable for furniture goods. The fibre is dyed with great facility and is the only textile fibre which takes equally the dyes destined for all tissues. On account of the stiffness of the fibre it is rarely woven alone, that is, when used for the filling, the warp is usually of cotton, silk or wool, and the reverse. It is not desired for its softness in addition to silkiness, such qualities as are found in cashmere and mauchamp wool, but for the elasticity, lustre, and durability of the fibre with sufficient fineness to enable it to be spun. Those who remember the fashions of thirty or forty years ago may call to mind the *camlets* so extensively used for cloaks and other outer garments, and will doubtless remember that some were distinguished for their peculiar lustre and durability, which was generally attributed to the presence of silk in the tissue. These camlets were woven from mohair. Its lustre and durability peculiarly fit this material for the manufacture of braids, buttons and bindings, which greatly outwear those of silk and wool. The qualities of lustre and elasticity particularly fit this material for its chief use, the manufacture of Utrecht velvets, commonly called furniture plush, the finest qualities of which are composed principally of mohair, the pile being formed of mohair warps which are cut in the same manner as silk warps in velvets. Upon passing the finger lightly over the surface of the best mohair plushes the rigidity and elasticity of the fibre will be distinctly perceived. The fibre springs back to its original uprightness when any pressure is removed. The best mohair plushes are almost indestructible. They have been in constant use on certain railroad cars in the country for over twenty years without wearing out. They are now sought by all the best railroads in the country as the most enduring of all coverings, an unconscious tribute to the remarkable qualities of this fibre. The manufacture of Utrecht velvets at Amiens in France consumes five hundred thousand pounds of mohair, which is spun in England. Ten thousand workmen were employed in weaving these goods at Amiens in 1855, the product being principally sent to the United States. The mohair plushes are made of yarns from No. 26 to No. 70; the tissues made of the former number are worth four francs per metre and of the latter ten francs per metre, showing the importance of preserving the fineness of the fleece. A medium article is made extensively in Prussia, of yarns spun from an admixture of mohair with combing wool, but it is wanting in the evenness of surface and brilliant reflections or bloom of the French goods. Mohair yarn is employed largely in Paris, Nismes, Lyons and Germany for the manufacture of laces, which are substituted for the silk lace fabrics of Valenciennes and Chantilly. The shawls frequently spoken of as made of Angora wool, are of a lace texture and do not correspond to the cashmere or Indian shawls. The shawls known as llama shawls are made of mohair. I have seen one at Stewart's wholesale establishment valued at eighty dollars, weighing only two and one third ounces. Mohair is also largely consumed at Bradford in England in the fabrication of light summer dress goods. They are woven with warps of silk and cotton, principally the latter, and the development of this manufacture is due principally to the improvements in making fine cotton warps, the combination of wool with mohair not being found advantageous. These goods are distinguished by their lustre, and by the rigidity of the fabric. All the mohair yarns used in Europe are spun in England, the English having broken down by temporary reduction of prices all attempts at spinning in France. Successful experiments in spinning and weaving Angora fabrics have been made in this country, as shown by the samples of yarns spun by Mr. Cameron, and the dress goods spun and woven by Mr. Fay of the Lowell Manufacturing Company from Angora wool grown by Mr. Chenery at Belmont.

Before the demand of this material for dress goods and plushes, mohair was largely used in Europe and this country for lastings for fine broadcloths, the lustrous surface acting as a frame in a picture to set off the goods. This use is now abandoned. Mohair is now extensively used to form the pile of certain styles of plushes used for ladies' cloakings, also for the pile of the best fabrics styled Astrakans. Narrow strips of the skin of the Angora with the fleece attached have been recently in fashion for trimmings, and great prices were obtained for a limited number of the pelts for this purpose. The skins with the fleeces attached will always bring high prices for foot rugs, on account of their peculiar lustre and the advantages they possess over those made of wool, in not being liable to felt.

Nearly all the raw mohair of commerce is at present consumed by a very few manufacturers in England, who first commenced spinning in 1835, at the suggestion of Mr. Southey, and soon excluded the Turkish yarns by the superiority and evenness of their yarns. The enormous works of Mr. Salt in England were erected in 1853, mainly for the manufacture of mohair and alpaca fabrics.* The annual exports of mohair from Turkey as well as other instructive facts are given in the following letter from a leading wool and commercial house in New York, obtained at my request.

New York, December 7, 1867.

Messrs. G. W. Bond & Co., Boston, —

Dear Sirs: — Agreeably with the request of your Mr. G. W. Bond, we beg herewith to hand you all the information we have regarding mohair or goats' wool.

Good mohair (Angora goat) is not known as an article of commerce anywhere but in Asia Minor. It is received from Asia Minor in bales varying from one hundred and fifty to two hundred pounds in weight, as most convenient, each fleece carefully rolled up and tightly packed. The exports from Turkey are as follows:—

1850	12,884 bales.
1860	11,902 "
1861	16,592 "
1862	17,706 "
1863	14,812 "
1864	19,761 "
1865	27,641 "
1866	22,068 "

We have seen samples of goats' wool grown in South Africa and this country, but they had degenerated, becoming coarser, and losing the lustre and silky appearance which gives the staple most of its value. It is consumed by less than a dozen houses in Europe; in fact, one firm consumes about one-third of the whole supply, and has agents in Turkey choosing the same. It is a very peculiar article; either everybody wants it, or no one will touch it. There seems to be no steadiness in the trade; but the demand is seldom in abeyance for more than four months at a time. Large buyers have avoided it for some time, therefore stocks have accumulated to a considerable but not excessive extent.

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* Vide James's History of the Worsted Manufactures.

About two years ago the price was up to nearly ninety-six cents gold, and fell, after long inaction, to about fifty to fifty-four cents gold per pound for super, white Constantinople: but even at this price there is very little demand. The value for second-class locky lots is always very uncertain. It forms, however only a trifling portion of the exports, and will fetch about twenty to thirty cents gold, per pound.

Fawn, a dark gray mohair, with long staple, is usually saleable at twenty-four cents gold to thirty cents currency. There is also a fair kind of brown mohair, but shorter and more cotted, that we think sells best in France at prices between twenty to thirty cents gold. The terms on which this article is sold in the market are cash in one month less five per cent. discount; England, tares actual and one pound draft per cwt. Yours faithfully,

BAUENDAHL & CO.

I have ascertained from other sources that the price of mohair in England of late years has been about double that of the best English combing wools.

RECAPITULATION AND CONCLUSION.

Experience in Europe, confirmed by observations in this country, has demonstrated the practicability of the acclimation of this race under favorable conditions of climate, without degeneracy of the fleeces. There are districts in this country possessing climate, temperature and hygrometric conditions, corresponding to those observed in Asia Minor and Europe as favorable to the culture of this race. The Angora goat and the domestic goat of Europe and this country having descended from separate sources, the obtaining of good results from the crosses of these two races is theoretically improbable, and is demonstrated to be so by the best experience in Europe. The normal fibre desired for the textile arts is only to be found in flocks of the perfectly pure race, and perhaps in flocks bred back to the standard of the pure race by crosses of a perfectly pure buck with the black Asiatic goats of the same race. It is desirable that importations should be made of the black female Kurd goat of Asia Minor, for crossing with the pure white bucks. There is evidence of great weight in favor of good results from such cases.

Systematic measures of acclimation must always be impeded by the eagerness of breeders for sale to obtain merchantable results. The appropriation of this race is of sufficient importance to deserve the earnest attention of the Government, as the best races of the merino sheep have been only secured through the persevering and disinterested efforts of governments in Europe. In the absence of any national society for acclimation in this country, a deficiency which ought not long to exist, the department of agriculture, under its present vigorous and intelligent head, offers the best means of securing the desired results. The cost of a single Rodman gun would secure a magnificent flock to serve for prolonged experiment and as a model to our agriculturists. Producers cannot expect to obtain remunerating prices for their fleeces until the manufacture of mohair fabrics is established in this country. It must be years before a sufficient supply is grown here to occupy a single mill. The fleeces of over ten thousand sheep are consumed every week in the single establishment of the Pacific Mills. It is probable that there will be a demand for all that can be grown for some time, for yarns for braids, and for Astrakhan cloakings which are being made in Rhode Island. The demand for animals of the pure race will increase without reference to the value of the fleeces. There are enough agriculturists of taste and wealth in this country who will readily pay large prices for these docile and beautiful animals simply as ornaments for their farms.

I am convinced that the greatest obstacle to the permanent acquisition of new resources from any department of nature is exaggerated expectations as to their value and facility of acquirement. Our impatient countrymen need to be reminded that real progress is the offspring not only of human effort but of time, and that of acclimation especially it may be said: *Non solum humani ingenii sed temporis quoque filia est.* There is encouragement however in the fact that the fruits of decades or centuries in older countries are matured here in years. In how brief a time has this vast country been stocked with all the animal wealth which Europe had to bestow! How rapidly have we appropriated all the best ovine and bovine races of the old world! Within half a century we have spread the merino sheep over all the prairies of the West, and within a less period have acquired and perfected the cattle of the Durham short horn breed, and even sent them back to ameliorate the parent stock in England. The hope then is not vain that the precious race, whose slow march westward we have traced from the remote East, may at no distant time be fully secured for the western world.

Mr. Geo. Wm. Bond exhibited samples of Angora wool obtained from animals raised in Kentucky by Mr. B. K. Tully. In his opinion they compared favorably in length of staple and fineness of fibre with any imported mohair. He pointed out the traces of the hair of the common goat upon the skins of the crosses of the Angora and common goat raised at the Cape of Good Hope, and observed that many of the fleeces offered in our markets as the product of Angora goats possessed the same character, facts which tended to confirm the views just advanced that it is undesirable to cross the Angora with the common goat.

CONCERNING A METEOR SEEN IN PRUSSIA. EXTRACTED FROM NEWSPAPERS AND PRIVATE LETTERS. BY DR. HERRMANN HAGEN.

On the 30th of January a brilliant meteor was observed in the provinces of East and West Prussia. Its brilliancy was uniform over a region of about one hundred and sixty square miles. The time at which the meteor appeared, is pronounced, with slight differences, to have been seven o'clock in the evening. An eye-witness in Hubnichen, who observed the appearance out of doors, describes it as a great beehive from under which luminous bees were swarming; and which, after its disappearance, left on the sky an illuminated wake.

The light was so intense that even bright lamps in a room in which the curtains were drawn were overpowered. It was seen throughout Samland. Mr. Otto Hagen, while in a hotel in Ortelsburg, hastened to a window, the curtains of which were drawn, believing that the houses on the opposite side of the street were on fire. Dr. P. published in the "Insterburger" paper a description of the appearance which he observed at Insterburg. He says: nearly in the zenith suddenly appeared a star of the size and brilliancy of the ball of a white roman candle, with a fan-shaped, comet-like tail; it proceeded from the north-west to the south-east, the dimensions and brilliancy of the ball continually increasing until the apparent diameter was nearly as large as that of the sun, and the eye could not bear the light. Presently the comet-like tail changed into an extraordinarily brilliant cone, more than twenty degrees in length, and its base a ball of fire. The country was illuminated for some seconds, as if by a bright flash of lightning, so that distant objects were seen more clearly than by day. Some twenty degrees above the horizon the light suddenly disappeared, the ball of fire apparently bursting into many hundreds of glowing fragments. The phenomenon lasted about fifteen seconds.

At Landsberg the meteor resembled a ball of eight or ten inches in diameter, and approached the earth, in eight seconds of time, from the north-west to the south-east. In Lyck, after the appearance of the intense light, distant thunder was heard.

At Loetzen and in Hohenstein it took a northerly direction from one hundred and ten to one hundred and twenty degrees, and lasted about four or five seconds. In Friedrichshof, before bursting, it appeared of an oval form. Mr. Kayser, astronomer of the Naturalists' Society at Danzic, writes among other things in his report: "On the evening of the 30th of January, I was surprised by the appearance of an uncommonly brilliant meteor falling in a southeasterly direction towards the east. It seemed to start from β Orion and run in a direct line with great and uniform brightness as far as Canis Major (Sirius), eight degrees above the horizon, bursting asunder at this place with a brilliancy still more intense; sparks spread themselves in all directions without detonation. The whole phenomenon scarcely lasted two seconds. At the place where the meteor burst, the azimuth was forty-six degrees eight minutes from south to east, so there must be a point on the direct line of Neuteich, Christburg, Saalfeld, Neidenburg, etc., in whose zenith this occurred. Consequently portions which have fallen to the earth may be sought for in that direction."

A meteoric stone of about a foot in diameter was subsequently found in the direction indicated.

Section of Entomology. March 25, 1868.

Mr. F. G. Sanborn in the chair. Twelve members present.

Dr. H. Hagen exhibited specimens of the stem of the cotton plant, sent to him from Euawa, Chicot Co., Arkansas; the stem had been longitudinally punctured to receive in its pith the eggs of an orthopterous insect; the eggs were pale yellow, one fifth of an inch long, cylindical, bluntly pointed and a little tapering at the end from which the larva emerges; the other extremity was rounded. The person who sent the twigs stated that the eggs were also found in blackberry vines, and were laid by a species of Locustarian resembling the Katy-did; they were doing much damage. He knew of several other species that deposit their eggs in the pith of twigs, and, of one, that inserts them under the scales of a gall, resembling a pine cone, found on the tips of twigs of a species of willow.

Mr. S. H. Scudder observed that he had received similar twigs from Mississippi, together with a specimen of the insect reported to have laid the egg; it proved to be an undescribed species of *Xiphidium*; he did not know of any similar observation excepting one published last month by Mr. S. I. Smith, in the Proceedings of the Portland Society of Natural History. Mr. Smith has found a specimen of the conical headed grasshopper, *Conocephalus ensiger*, with its ovipositor forced down between the root leaves and the stalk of a species of *Andropogon*.

Dr. Hagen remarked that he had been examining the Pseudoscorpions of America and comparing them with European species sent to him by Dr. Menge. *Chelifer muricatus* of Say proved to be identical with the European *C. cancroides*. He had determined eight species, one, hitherto undescribed, resembling *C. maculatus* Menge, belonging to the genus *Chthonius*; four, belonging to the genus *Chelifer*; two, one of which was new, referable to *Chernes*; and one belonging to *Pelorus*.

Mr. S. H. Scudder presented the following description of a new Butterfly from Florida: —

Thecla Juanita. Head black; a circular pearly white spot between the antennæ, another just behind the summit of the eyes, a long and slender one in front of, and another behind the eyes; base and centre of the palpi white; basal half of antennæ black (remainder broken); a transverse plume of mingled black and white hairs on the vertex, behind which is a collar of shorter white hairs; thorax and abdomen well sprinkled above with bright blue scales on a brownish ground; thorax beneath black; a white dot on the pleura at the base of either wing; legs black with occasional white scales; abdomen beneath orange. Wings above blackish-brown; primaries profusely suffused with bright blue (steel blue by reflected light) on the basal half, especially along the middle of the wing, but not between the divarications of the median nervure; fringe black tipped with gray; secondaries somewhat suffused with bright blue, especially along the area occupied by the median nervure and its divarications; there are two long tails; the upper is the extension of the middle median nervule, the lower, which is twice as long as the other, is the continuation of the first branch of the median nervure; the internal area is slightly excavated near the extremity and the portion beyond curved sharply over and beneath, at fully a right angle to the general plane of the wing; on the lower half of the outer margin of the wing are three spots, made up of yellowish-brassy, greenish-brassy and bluish-brassy scales; that in the internal area is longitudinally oval, that between the median and sub-median nervures, transversely oval, and that between the tails transversely linear and least variable in coloration; the middle spot is also surmounted by a number of inconspicuous deep tawny scales; on the internal area there is another similar but irregularly shaped spot within but close to the outer one; internal area with long bluish gray hairs; fringe, as far as the longer tail, black tipped with gray; beyond white at extreme base; the outer parts black; wholly black beyond the spot on the anal angle.

Beneath, glossy grayish-brown, lightest in tint toward the apices of the wings; extreme base of the primaries velvety black with a longitudinally oblong-ovate, bright, very deep orange-red spot in the costal area, but scarcely reaching the edge of the wing; extreme base of the secondaries velvety black with two bright, very deep orange-red spots; one, circular, similarly situated to that on the primaries, the other, longitudinally oval, in the internal area; there is a transverse curving submarginal row of very bright, brassy-green, transversely ovate spots bordered with black, extending from the middle median nervule to the internal border; there is a row of marginal spots generally similar to those of the upper surface; the deep tawny spots are, however, found in all the interspaces, are more conspicuous and between them and the submarginal row mentioned, is a row of transversely linear spots similar to the marginal spots. Expanse of wings two inches; length of lower tail seven-tenths of an inch.

Mr. Edward Burgess took this exquisite little butterfly on the blossoms of peach trees, in Pilatka, Florida, on the tenth of February. It bears a general resemblance to *Papilio Halesia* of Cramer and *Atlides Dolichos* of Hübner.

Mr. S. H. Scudder stated that he had recently received, from Mr. Lincecum of Texas, the eggs and egg-cases of the destructive grasshopper, *Caloptenus spretus*, which reappeared in that State on the 19th of February; some of the eggs had hatched on the way, and larvæ both of the first and second stages were found in the box; unfortunately the cold weather has killed them all.

Mr. L. Trouvelot exhibited a cluster of very interesting eggs of a large unknown lace-winged fly, probably a *Corydalis*; the eggs were found under a bridge. He also showed some drawings of *Cysticerci* which he had taken from the abdominal cavity of the rabbit. Twelve were found in one animal, two of them on or near the liver, and two hundred and sixty in another, most of them near the extremity of the intestinal canal, although two had penetrated the lungs. The worms in the two rabbits were of different forms, but Mr. Trouvelot considered them as probably identical on account of the similarity of their mouth parts. Imbedded beneath the skin of the second rabbit, on the underside of the neck, he also found the larva of an *Œstrus*.

April 1, 1868,

The President in the chair. Forty-three members present.

Mr. Sanford B. Dole of Honolulu, Hawaiian Islands, was elected a Corresponding Member.

Rev. John B. Perry, Drs. L. D. Shepard and George G. Tarbell, and Messrs. Joseph T. Brown, Jr., John Bryant, Albert J. Cook, Horace F. Carpenter, William Holden, Joseph H. Lathrop, Samuel T. Morse and Edward A. Strong were elected Resident Members.

Professor Gamgee of England, was introduced by the President, and offered some remarks on antiseptics for the preservation of meats.

Prof. Gamgee stated that the insufficiency of the supply of animal food in the markets of Great Britain had led him to investigate the various groups of maladies affecting cattle in the Old World, especially those which spread with such frightful rapidity from one country to another through the lines of transit of cattle trains; but efforts in that direction proving only partially successful, and the price of many kinds of meat having risen from thirty to forty per cent. in seventeen years, he had commenced in 1865 a series of experiments on preserving meats in bulk, without the use of salt or desiccation.

The conclusion was early reached that the tissues of the animal should be fixed previous to its death; ingredients containing tannin were first used, and the carcasses, packed in fat, remained in good condition for a great length of time; this failed, however, in the case of one animal, which persistently refused to partake of the drug; and as herds of cattle could not readily be induced to feed on tannin, some other expedient was necessary; having proved the antiseptic effects of carbonic oxide gas, by its tendency to expel oxygen, animals were made to inhale the gas, and the result showed that decomposition took place only when the carbonic oxide disappeared; to effect the complete removal of the oxygen, the use of sulphurous acid gas, well known as an expedient for curing hams for exportation, was resorted to; by itself, the acid could not prove successful, as it would remain in contact with the oxygen for an indefinite length of time without material change in either; the carcass was therefore placed beneath the air pump, the sulphurous acid gas introduced, and charcoal, platinized by the use of chloride of platinum passed up through a column of mercury; the sulphurous acid gas was thus oxydized and the atmosphere entirely destroyed; simple carbon was subsequently found equally efficient, and the plan was finally simplified by the introduction of a small quantity of carbon in which sulphurous acid was condensed; in this way the measurement of definite quantities became an easy matter.

The process now consists of causing the animal to inhale carbonic oxide gas until it loses consciousness, when it is killed and bled; the carcass is quickly dressed and while still warm placed for a short time beneath an air pump; the small quantity of air which this process fails to exhaust is destroyed by the introduction of sulphurous acid gas in charcoal. The meat will then keep for months and perhaps years, in any temperature, without putrefaction, even though it be filled with the maggots of flies. It is not believed that the sulphurous acid, which is neutralized by the alkalies of the meat, can have any injurious effect on the tissues.

The experiment of preparing animals on a large scale by this process will soon be attempted, and the result cannot fail to affect the price of meat very materially.

Section of Microscopy. April 8, 1868.

Mr. R. C. Greenleaf in the chair. Eight members present.

Mr. C. Stodder read the following report of an investigation of soundings made in ten fathoms of water off the coast of Maine, near Mt. Desert Island, by Mr. C. P. Dillaway: —

The material is a light brown colored paste. On treating it with sulphuric acid, it swelled and effervesced rapidly, giving off an abundance of sulphuretted hydrogen—a reaction I never before found in "sounding" specimens. It contains, among a large quantity of siliceous sand, a few Dictyoca, a very few fragments of Polycistina and an abundance of sponge spiculæ—an unusually large proportion of them being broken; possibly some of the broken spines may belong to the Polycistina.

There are many species of Diatomaceæ, but the quantity is very small, perhaps not more than one per cent. of the bulk. I have identified: —

Nitzchia lanceolata.
Pinnularia (Navicula) peregrina.
Navicula Smithii.
" lyra.
" retusa.
Cocconeis scutellum.
" major.
Coscinodiscus linearis.
" radiatus.
" patina.
" ——?
Melosira sulcata.
" (Orthosira) granulata?
Pleurosigma elongatum.
Pleurosigma delicatulum.
" angulatum? var.
Actinoptychus senarius.
Dicladia capriolus.
Biddulphia aurita.
Grammatophora angulosa.
" ——?
Gomphonema curvatum.
Rhabdonema arcuatum.
Stauroneis aspera.
Plagiogramma Gregorianum.
Rhizosolenia ——?
Periptera ——?

The representatives of most of these species are very few in number, but a single specimen of some having been found. Melosira sulcata Ralfs(=Orthosira marina Smith,=Galionella sulcata Ehr.) is the most abundant form, about equaling in number all the others, and the specimens are very fine. Coscinodiscus linearis is the next plentiful, and also fine and perfect. Another species of Coscinodiscus occurs, belonging to the group which includes C. stellaris Roper and C. tenuis Bail., but without some of the characters of either these or other described species. The Periptera does not agree perfectly with any published species, and the Rhizosoleniæ were all too much broken to afford specific characters.

Melosira granulata is said by all the authorities to be a fresh water form, but the specimens have all the characters of that species.

It would be an unwarranted conclusion that these organisms were obtained from their native locality. From their minute size they may have been brought by currents or winds, or in the intestines of fish or birds from far distant places.

The Melosira sulcata is the only one sufficiently abundant to indicate that it was found in its native habitat.

April 15, 1868.

The President in the chair. Thirty-five members present.

The following paper was read:—

OBSERVATIONS ON CRANIA. By JEFFRIES WYMAN, M.D.

1. MEASUREMENT OF SKULLS.

Tiedemann appears to have been the first to attempt anything like an extensive comparison of human crania based upon their capacity.* To this end, 1, he weighed the skull without the lower jaw; 2, filled the skull with dried millet seed and weighed again; 3, deducting the weight of the skull he obtained the weight of the millet seed filling it. Thus a means for determining the comparative size of the cranial cavity in different individuals or races was obtained, but it failed to give any exact idea of the volume of the brain. The method proposed by Sir William Hamilton was more successful; he filled the cranium with fine sand, which was measured in cubic inches; having determined the weight of a cubic inch of sand, he multiplied this by the number of cubic inches contained in the skull, and making a correction for the difference in the specific gravities of brain and sand, the weight of the brain was approximately reached.† Prof. Daniel Treadwell has proposed a somewhat similar, but more simple method than this; it consists in determining, by any given method, the capacity of the skull in cubic inches, multiplying this by the weight of a cubic inch of water, and correcting for the difference between the specific gravities of brain and water, we have, as in the other case, cubic contents converted into brain weight.* The method proposed by Prof. Treadwell has an advantage in the fact that the weight of a cubic inch of water (252.5 grains, or 16.4 grams) has been determined with great accuracy, and is a constant quantity; while that of a cubic inch of sand varies according to locality, requiring a fresh determination each time a different kind of sand is used.

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* Philos. Trans. of the Royal Society of London, 1836, p. 497.

† Lects. on Metaphysics and Logic. Edinburgh, 1860. Vol. I.; p. 240.

The nature of the material used for measuring the capacity of the skull is important, but observers have had recourse to very different kinds. Water would unquestionably be the best, but its use is impracticable owing to the great difficulty in making the cranium sufficiently tight to retain it. The late Dr. Samuel George Morton, having used white mustard seed "on account of its spherical form, its hardness, and the equal size of its grains," afterwards, at the suggestion of Mr. J. S. Phillips, substituted No. 8 shot which he found to give much more precise results, and with these all the measurements recorded in his tables were made.† Sir William Hamilton sharply criticises Dr. Morton's method as "only a clumsy and unsatisfactory imitation of mine," asserting that "pure silicious sand was the best means of accomplishing the purpose, from its suitable ponderosity, incompressibility, equality of weight in all weathers, and tenuity."‡ Dr. J. Barnard Davis, whose practical knowledge of the subject makes his opinion worthy of high consideration, also recommends the use of fine sand, § but instead of measuring he weighs the quantity the skull holds. Having ascertained the cubic measure of an ounce of sand, the whole quantity is readily converted into cubic inches, or by making a correction for difference in specific gravity, into brain weight. Various other substances, such as peas, flax seed, rice, etc., have been used. Welcker recommends the grains of husked wheat. For a full account of these and of the different methods of comparing crania, the reader is referred to the valuable and instructive memoir of Dr. J. Aitken Meigs, on the Mensuration of the Human Skull.||

From the following table, the result of careful comparative experiments, it will be seen that, for exactness, shot are far preferable to sand, and that Sir William Hamilton's criticisms are unjust. The chief requisites for a good material for measuring crania, are lightness and uniformity in the size of the particles or component bodies; the size should be such that they will not escape from the foramina in the orbit, and their shape such that they will occupy the smallest

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* American Journal of Medical Science, in the account of the last illness of the Hon. Daniel Webster. January, 1853.

† Crania Americana, p. 253.

‡ Op. cit. Vol. I., p. 240.

§ Crania Britannica.

|| North American Med. Chirur. Review, Sept. 1861, p. 837.

compass with the least amount of shaking or compression. All these conditions were very nearly found in peas, and with the exception of lightness were realized in shot, the diameter in the second case being about 0.18 inch, and in the first 0.23 to 0.25 inch. Shot have the advantage over all other materials in their spherical shape, but their weight is such that fragile crania would be destroyed by them, though they may be safely used with those of ordinary strength. A skull having a capacity of ninety cubic inches when filled with shot weighs more then twenty pounds, which is altogether too heavy a mass to handle when many crania are to be examined.

With the view of determining the relative value of different materials, one and the same skull was measured eight times with each of the different kinds mentioned at the head of the columns of the table. The cranium was filled with a given material, which was well shaken down and compressed until no more could be received. The contents were then poured into a measure, care being taken that this should be done in each case at a uniform rate, but *without* being afterwards shaken or pressed down. The measure used was a litre, and the measurements are noted in cubic centimetres.

	Peas.	Shot.	Beans.	Rice.	Flaxseed.	Coarse Sand.	Fine Sand.
1	1190	1200	1210	1220	1250	1250	1315
2	1190	1205	1210	1222	1250	1260	1320
3	1190	1205	1210	1220	1240	1250	1290
4	1195	1200	1205	1220	1255	1260	1290
5	1198	1200	1210	1215	1250	1270	1320
6	1190	1200	1200	1220	1250	1250	1290
7	1195	1200	1205	1225	1240	1260	1350
8	1196	1205	1200	1220	1245	1260	1330
Aver'ge.	1193	1201.8	1206.2	1220.2	1247.5	1257.5	1313
Range.	8	5	10	10	15	20	60

From this table, it will be seen that the skull being carefully filled in each case, its capacity apparently varied according to the different substances used in the measurement; with peas it was 1193 c. c. and with fine sand 1313 c. c., or 120 c. c. more. This difference depends upon the fact that the substances used, under similar circumstances, adjust themselves to the least space with different degrees of facility. Shot and peas having a spherical shape the position in which they happen to fall is a matter of indifference, since all their diameters are equal. The other bodies whose diameters are unequal, require more or less of shaking and pressure in order that they may be packed in the smallest compass and thus an exaggeration of the capacity avoided. With proper care, correct measurements can of course be made with either of the materials mentioned in the table, and in practice no one would omit to shake down and compress the material in the measure to the same degree that he would in the skull. The object of the table is only to show the comparative amount of compression and adjustment required. To present the subject in another way, if a litre is filled with peas, and then shaken, it will diminish one per cent. in bulk, while, under similar circumstances, coarse sand diminishes fifteen per cent. In the first case the error will not exceed one per cent.; in the second it may be, unless great care is taken, much more. Of the different substances used, peas and shot, on account of their spherical shape, gave the best results, and coarse and fine sand the worst, on account of the irregular shape of the grains, the small size of these, for the finer the material the greater the error, and the roughness of their surfaces. As to peas and shot, the last give the most accurate and uniform results, while the latter, being less perfect spheres, lead to a slight error, but have the advantage in lightness, thus making manipulation more easy. Sand has the further disadvantage of filling many angles, canals, and foramina not occupied by brain, and therefore of exaggerating the quantity of this last, and in requiring that the foramina in the orbit should be plugged to prevent its escape. This last objection is of little moment when a single skull is to be measured, but is considerable when the number is large. By using bodies of the size of peas or shot, the inconvenience and the exaggeration are both avoided. The difference in the table between the amount obtained by measuring with peas and shot depends upon the larger size of the latter.

There is still another step to be taken, even if an exact measurement of the cranium has been made. The brain, as already stated, does not fill the cranial cavity; a space, variously estimated, is occupied by the membranes and the vessels, which should be deducted from the general internal capacity. Welcker estimates this at from 11.6 to 14 per cent. of the whole cavity, according as the skull varies in size. Dr. J. Barnard Davis makes a correction of 10 per cent.

Brain, not cranial measurement, is, of course, the object of the study of the capacity of the skull; but until some definite results are obtained, which will enable the observer to make accurate corrections, we must remain content with cranial measurement for the present, and apply the corrections hereafter.

If we set aside shot as not well adapted to the purpose of measurement on account of their weight, a material suitable for equally accurate measurement is still a desideratum. Peas are not of a uniform size, though by sifting, uniformity may be approached, and there is a certain amount of error growing out of their want of sphericity, though this is quite small. Spheres of porcelain of the size indicated above, and still better of aluminium, on account of its lightness, would give the required qualities for accurate measurement.

The results obtained by various observers in making comparative measurements of crania point to one of the following methods as the most desirable.

I. *a.* Fill the skull and *weigh* the contained material.
   b. Convert weight of material into cubic measurement by determining the cubic measurement of a gram or an ounce of material, and multiplying this by the whole number of grams or ounces. With proper tables, this would be a quick and easy process, but otherwise a tedious one.
   c. Convert weight of material into brain weight by correcting for difference in specific gravity.

II. *a.* Fill the skull and *measure* the contained material.
   b. Convert cubic contents into brain weight by multiplying the number of cubic inches by the weight of a cubic inch of water (252.5 grains), or the number of cubic centimeters by the weight of a cubic centimeter of water (one gram), and allowing four per cent. for the difference of the specific gravities of brain and water.

The second has the advantage of being the more simple process, and requires the fewest steps, while the first has the advantage in weighing, which is a somewhat more accurate method than measuring. The weight, however, must be converted into cubic measure, if we compare skulls by their cubic contents. With care, either of them are sufficiently correct, and in his choice the observer can and will be guided by his likings.

2. Position of the Foramen Magnum.

The fact, to which attention was called by Daubenton, more than a century ago,* that the foramen magnum is situated farther back in apes than in man, naturally led anatomists to inquire whether any of the human races more nearly approach the apes in this respect than the rest. Soemmering made the assertion that such is the case in the Negro, and his statement has been quite generally repeated by subsequent writers. Prichard, however, satisfied himself that such is not the case, and after having examined "many Negro skulls," states that the foramen corresponds in position with that of the white races, viz.: "exactly behind the middle of the antero-posterior diameter of the basis cranii."* He, however, finds it necessary, in order that this should be the case, to make some allowance for the projection of the jaws. We have seen no account of the manner in which the measurements on which this opinion rests were made, except that the jaws were included when the antero-posterior diameter of the head is spoken of. It is obvious that in comparing more or less prognathous races, the position of the foramen magnum may be found to vary, although there may be no variation when the cranium proper is alone considered. In other words, the bones of the face may vary independently of the cranium.

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* Sur la Différence du Grand Trou Occipital dans l'Homme et dans les autres Animaux. Mémoires de l'Acad. des Sciences, 1764.

The more common method adopted has been to measure from the anterior edge of the foramen magnum to the edge of the alveoli in the middle of the upper jaw, and from the foramen to the most prominent point of the occiput. It seems to us more correct to determine the position of the foramen, with regard to the cranium, than with regard to the cranium and face, especially as the chief interest which attaches to the foramen is as an index of the relation of the spinal marrow to the cerebral mass.

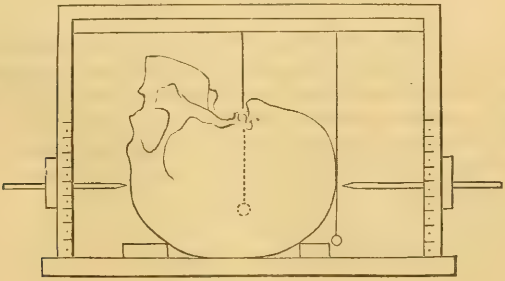

Fig. 1.

In making the measurements on which the following table is based, we have kept this circumstance in view, and have adopted the following method. The cranium is placed inverted in the instrument represented in the accompanying figure (Fig. 1,) the long diameter, from the glabella to the occiput, having been previously measured with the callipers, is made horizontal by bringing the two ends of it to correspond with the points of the indices on the graduated uprights, and on which the indices are adjusted to the same elevation. Two moveable plumb lines, suspended from a wire stretched across the upper part of the frame, are then so adjusted that one dropping through the foramen magnum touches its anterior border, while the other touches the most prominent part of the occiput. The position of the foramen is indicated by the ratio of the distance comprised between the two plumb lines, to the long diameter of the cranium proper. The number expressing this ratio may be called *the index of the foramen magnum*, thus conforming to the method of expressing the ratio of the breadth, or the height to the length. When it is said that the index of the foramen magnum is 45.4, it is understood that the distance of the anterior edge of the foramen from the most projecting part of the occiput, is 45.4 parts of the long diameter, this last being considered 100, and both being projected on to the same plane.

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* Researches into the Physical History of Man. London, 1851. Vol. I., p. 285.

To avoid error, it is important that the long diameter of the head should be made as nearly horizontal as possible, for the foramen magnum being on a higher plane, moves through an arc of a circle, which, as the long diameter is tilted backwards or forwards, changes the position of the point where the vertical cuts the horizontal line.

	20 White.	5 Tsuktchi.	17 Negroes.	28 S. Islanders.	19 Hindoos.	5 N. American Indians.	3 Gorillas.	1 young Gorilla.	1 Chimpanzee.	3 young Chimpanzees.
Maximum,	50.0	47.2	48.7	47.5	45.4	47.8	26.8			39
Mean,	45.6	45.3	44.4	41.8	41.4	40.9	22.7	40	21	35.3
Minimum,	41.7	44	38.7	36.1	35.6	34.8	17.7			32
Range,	8.3	3.2	10.0	11.4	9.8	13.0				

The preceding table, in which the number of the skulls of each race examined is given at the top of the respective columns, shows that there is an actual difference in the position of the foramen magnum in the races compared, and of such an amount as to make it desirable to test the result with much larger collections, in order to determine more precisely the value of the position of this opening as a race character.

As far as this table can be accepted, it shows that while there is a difference between the human races as regards the position of the foramen magnum, it is quite small when compared with the difference between the human races and the apes; and contrary to Soemmering's assertion, the Negro does not make the nearest approach to the latter. It is the North American Indian which has the lowest index.*

3. Crania from the Island of Kauai.

Mr. Horace Mann of Cambridge, soon after his return from a botanical excursion to the Hawaiian Islands, called my attention to the fact that large numbers of crania and bones of the natives could be had at Kauai. He kindly obtained for me the aid of Mr. Sanford B. Dole, at that time residing there, by whom the valuable collection described below was made, and to whom I would here express my indebtedness for the interest he has taken in the subject. The following letter, written by Mr. Dole after his arrival in the United States, will explain the circumstances under which they were found.

Williamstown, June 24, 1867.

Prof. Wyman:—

Dear Sir: On the southern shore of the Island of Kauai, for about four miles, there is a series of low, volcanic hills facing the sea, with precipices varying in height from twenty to sixty feet. Between these hills are several low sand beaches, from which the sand is ever carried inland by the trades. The windward slopes of these hills are covered with white sand of varying depth.

Over this whole extent of sand beaches and hills, human bones are thickly scattered, and here it was that I collected the skulls. Ten years ago they were much more numerous than now. The wind is constantly uncovering the skeletons, and, when exposed, they are quickly destroyed by the weather and the feet of cattle. At the time I speak of, it was easy to find perfect skeletons in the exact position in which they were buried. This is now impossible, and even perfect crania are becoming more scarce with every year. In olden times the natives often made use of the soft sand-banks for sepulture, but the immense number that was buried here forbids the idea that it was any common burying place. The present generation of natives know nothing definite on the subject. One of their traditions, as near as I can remember, is, that a fight between two large fleets of canoes took place off the coast, and that the defeated party was driven ashore at this place, and many of them killed. A second tradition is this; a tribe passing along the coast in canoes, and having landed in a secluded little cove which is now pointed out, to bathe and refresh themselves, a rival tribe charged down from the hills around and cut off almost the whole party.

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* The position of the foramen magnum, as will be seen by this table, is very different in the young from what it is in the adult apes, the former approaching much nearer to the human races than the latter. We have pointed out in a former volume of the Proceedings (ix, p. 203) other striking resemblances between the cranium of the young gorilla and the adult man, which are much diminished as age advances.

CRANIA OBTAINED FROM

No.	Weight.	Capacity.	Length.	Breadth.	Frontal Diameter.	Height.	Index of Breadth.	Index of Height.	Index of F. Magnum.
1	710	1465	185	143	92	130	773	751	443
2	485	1280	170	141	90	130	829	764	435
3	757	1555	168	158	95	141	940	839	416
4	735	1490	178	138	91	135	720	700	406
5	782	1350	172	146	91	139	848	808	430
6	700	1370	177	136	96	142	767	802	401
7	845	1670	180	153	95	139	850	772	394
8	750	1560	177	148	95	141	836	796	361
9	562	1390	173	144	93	133	832	768	421
10	593	1400	165	138	97	137	833	830	375
11	575	1240	169	132	94	134	777	786	413
12	645	1280	174	135	95	133	775	764	413
13	377	1230	157	134	82	128	853	815	433
14	595	1170	160	132	87	131	824	818	406
15	677	1610	191	144	95	135	755	706	475
16	678	1470	180	147	98	132	816	733	405
17	494	1380	167	148	93	132	886	790	413
18	495	1350	180	135	88	130	750	722	394
19	512	1350	175	138	92	132	788	754	393
20	555	1160	165	134	90	127	812	769	396
21	663	1400	179	141	88	133	731	743	400
Max'm,	845	1670	191	158	98	142	940	839	475
Mean,	640.4	1397	174.2	141.5	92.7	134.3	807	770.7	413.5
Min'm,	485	1160	160	132	82	127	720	700	361
Range,	360	510	31	26	16	15	220	139	114

NOTE.—Weight in grams; capacity in cub. cent.; lengths in m.m. The Index of breadth, height, and of foramen magnum, is in thousandths of the long diameter. No. 13, being that of a child, is not taken into account in the averages.

THE ISLAND OF KAUI.

No.	Frontal Arch.	Parietal Arch.	Occipital Arch.	Circumference.	Longitudinal Arch.	Length of Frontal.	Length of Parietal.	Length of Occipital.	Zygomatic Diameter.
1	303	318	232	524	380	140	124	114	142
2	281	326	210	484	348	126	113	108	126
3	307	380	226	522	370	133	130	107	139
4	300	340	227	512	378	140	130	107	136
5	279	334	229	502	362	127	120	115	125
6	300	326	237	502	376	126	124	116	——
7	302	360	223	528	390	136	135	117	138
8	302	352	220	510	374	135	131	106	133
9	295	333	220	504	368	135	119	112	128
10	283	340	238	450	342	127	122	103	137
11	282	338	232	486	358	120	122	114	132
12	286	328	219	480	346	122	111	110	128
13	262	330	184	456	338	116	115	107	101
14	279	328	200	464	346	120	117	107	122
15	295	344	260	536	390	136	143	111	132
16	302	346	245	532	370	133	110	125	——
17	291	334	225	504	358	127	120	112	137
18	297	328	225	504	368	125	131	112	129
19	300	332	225	506	358	126	120	110	127
20	290	316	215	482	346	123	114	109	133
21	299	338	235	510	370	132	125	112	131
Max'm,	307	380	260	536	390	140	143	125	142
Mean,	290.5	337	227	502	364.9	127.9	123	111.3	131.3
Min'm,	279	316	200	450	342	120	110	103	122
Range,	28	64	60	86	48	20	33	22	20

NOTE.—Weight in grams; capacity in cub. cent.; lengths in m.m. The Index of breadth, height, and of foramen magnum, is in thousandths of the long diameter. No. 13, being that of a child, is not taken into account in the averages.

Those who have studied the subject, I think, give to the great pestilence, *Mai Ahulau*, which raged through the islands soon after their discovery, the credit of peopling this and other similar graveyards. Infant skulls are sometimes found, and also skulls that appear as if they had been pierced by spears, or fractured with clubs. The skulls which I collected for you were some of them above, and some below, the surface of the sand.

Yours truly,

S. B. Dole.

The collection is the more valuable, from the fact that the crania were all obtained from the same place, and from an island not commonly mentioned in the catalogues. Dr. J. Barnard Davis, in his Thesaurus Craniorum, out of one hundred and thirty-nine Kanaka skulls, does not mention one from Kauai. They are nearly all adult, No. 13 being the only one belonging to a child. As far as they go, they do not afford evidence of having been killed in battle, as they bear no marks of injuries inflicted by weapons. A few show signs of disease, as if they had been the seat of periosteal inflammation.

The average internal capacity, 1397 c. c., is 127 c. c. less than that of the average European, 1524 c. c., according to the tables of Morton. The largest is 1671 c. c., or a little less than one hundred and two cubic inches. The average capacity of one hundred and twenty-one Kanaka skulls from Hawaii and Oahu, as stated by Dr. Davis in his Thesaurus, is 89.6 cubic inches, or 1466.7 c. c. As the average index of breadth is 80.7, the skulls, as a whole, must be considered as brachycephalic. Nevertheless some of them have the dolichocephalic proportions strongly marked; for while No. 7 has an index of 85.0, and No. 3 of 94.0, No. 4 has an index of only 72.0. We have here the same result as that arrived at in the study of other races, especially in the North American Indians, as seen in the extended and careful comparisons of Dr. Meigs, showing the necessity of having as large a number of crania as possible for comparison, and the worthlessness of observations made on a single skull. As each race exhibits a wide range of variation in each of its characters, a given race can be rightly defined only when its predominant features, seen in many individuals, have been ascertained.

The index of the foramen magnum is only 41.2, and this opening is therefore much farther back than in the European races, and, as seen in the table, p. 446, has nearly the position of that of the North American Indians. In more than one half of the specimens the portion of the occiput surrounding the foramen is somewhat raised (the skull being inverted), giving it a funnel-shaped appearaace.

More than one-half of the crania have the peculiarity in the opening of the nostrils, to which attention was first called by Dr. John Neil of Philadelphia, as characterizing the skulls of negroes, viz.: the deficiency of the sharp ridge which forms the lower border of this opening, and in the place of it a rounded border, or an inclined plane. This feature is, however, found very frequently in different races, but more rarely in Europeans than the others. The ridge in question is always absent in the apes.

In many of the crania the occiput was somewhat flattened, but the outlines form regular curves, and the usual signs that the flattening is artificial are not seen.

Four of the crania have small bony nodules, varying from one to three in number, developed in the auditory meatus, which in one case, with the integument, must have quite closed it. Dr. J. Barnard Davis informs me that similar nodules were discovered by Prof. Seligmann of Vienna, in ancient Peruvian crania, and have been observed by himself and Welcker in other cases.* They appear, however, to be the most common in the ancient Peruvians and the inhabitants of the Pacific Islands.

There is only one instance in which the incisors have been punched out, while in the one hundred and forty crania from Hawaii and Oahu, described by Dr. Davis, more than one-third had been so deformed. A few anomalies of the teeth are noticeable, as in some cases the small size, in others the retention in the alveoli, and in others the absence of the wisdom teeth. In one case a præmolar was rotated so as to present its two cusps in a line from before backwards, instead of from side to side.

4. Crania of Tsuktshi.

The writer is indebted to the liberality of the Smithsonian Institution for the opportunity of examining the crania described below. The first five are those of the Wandering or Reindeer Tsuktshi, and were all obtained from the Asiatic side of Behring's Straits. Three are from Plover Bay, which is just west of Cape Choukotski, and were collected by Mr. William H. Dall, a zealous explorer, and one of the Scientific Corps of the Western Union Telegraph Company; the fourth is from Arikamcheche Island (Kayne Island of the United States Coast Survey Map of 1867), and was obtained by Dr. William Stimpson, one of the naturalists of the North Pacific Exploring Expedition, under Com. Rodgers; the locality of the fifth is not stated.

For the purpose of comparison, there are given in the table the measurements of five crania from the Yukon River, three of which are Mahlemuts, also collected by Mr. Dall, of eleven from California, and of eight Flatheads from Washington Territory and Oregon, nearly all of which belong to the collections of the Smithsonian Insti-

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* See Thesaurus Craniorum.

RACE.	No.*	Weight.	Capacity.	Length.	Breadth.	Breadth of Frontal.	Height.	Index of Breadth.	Index of Height.	Index of Foramen Magnum.
Tsuktshi,	4538	560	1425	171	141	102	133	824	777	450
"	4612	450	1400	176	137	94	134	778	761	448
"	7117	860	1570	180	148	95	132	822	733	472
"	7118	625	1490	177	135	103	130	762	734	440
	7120	610	1455	177	147	101	125	830	706	457
Mean,		621	1468	176.2	141.6	99	130.8	803.2	742.2	453.4
Tunguse,				190	148			778.9		
Esquimaux,										
Mean, 20 crania .			1475	178	133		139	720	758	
Cranium from Dr. Parks,		580	1440	183	138	94	131	754	715	437
Cast,				192	134			696		
Mean			1457.5	184.3	134.5		135	723.3	736.5	
Yukon River,	7530	710	1460	183	140	101	136	765	743	371
"	7531	735	1240	176	132	91	131	750	744	409
"	7532	545	1190	172	129	92	127	750	738	395
"	7533	781	1380	179	134	94	130	748	726	424
"	7534	445	1200	169	132	86	123	781	727	414
Mean,		643.2	1294	175.8	133.5	92.8	129.5	758.8	735.6	402.6
Mean of eleven Californians,		551.1	1259.2	170	150.5	93.5	120.8	833.4	717.5	422
Mean of eight Flat Heads,		582.1	1330	158.8	152	98	118.5	954	784.4	424
			Tsu.	Tun.	Cal.	Esq.	Esq.	Cal.	Tsu.	Tsu.
			Esq.	Esq.	Tun.	Tsu.	Tsu.	Tsu.	Esq.	Esq.
			Yuk.	Tsu.	Tsu.	Yuk.	Yuk.	Tun.	Yuk.	Cal.
			Cal.	Yuk.	Esq.	Cal.	Cal.	Yuk.	Cal.	Yuk.
				Cal.	Yuk.			Esq.		

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* Numbers refer to Catalogues of the Smithsonian Institution. Weight in grams; capacity in cubic centimetres, other measurements in millimetres.

Race.	No.*	Frontal Arch.	Parietal Arch.	Occipital Arch.	Longitudinal Arch.	Circumference.	Length of Frontal.	Length of Parietal.	Length of Occipital.	Zygomatic diameter.
Tsuktshi,	4738	300	316	259	360	508	124	112	123	146
"	4612	285	310	238	366	496	130	130	107	131
"	7117	292	358	277	384	530	130	125	132	132
"	7118	305	316	249	332	508	134	118	110	140
"	7120	300	326	285	336	530	125	126	115	143
Mean,		296.5	325.2	261.6	367.6	514.4	128.6	122.2	117.4	138.4
Tunguse,		297	310	295	376	538	130	125	119	148
Esquimaux,										
Mean, 20 crania					372	513	124	124	122	135
Cranium from Dr. Parks,		290	316	262	360	512	126	115	121	142
Cast,		303	324	281	382	530	127	130	126	136
Mean,		296.5	320	271.5	371.3	518.3	126.6	123	123	137.6
Yukon River,	7530	307	326	240	372	514	130	130	110	140
"	7531	284	304	265	354	492	124	119	112	130
"	7532	280	280	232	346	486	112	112	122	132
"	7533	291	314	253	370	480	127	111	131	129
"	7534	270	282	228	340	506	116	120	104	129
Mean,		285.5	301.2	243.6	356.4	495.6	121.8	118.5	115.8	132
Mean of eleven Californians.		260.1	312.4	256	346	495	117.4	111.2	114.7	134.9
Mean of eight Flatheads,		287	337.7	245.5	333	493	117	105.7	108	136
		Tun.	Tsu.	Esq.	Tun.	Tun.	Tun.	Tun.	Esq.	Tun.
		Tsu.	Esq.	Tsu.	Tsu.	Esq.	Tsu.	Esq.	Tun.	Tsu.
		Esq.	Cal.	Cal.	Esq.	Tsu.	Esq.	Tsu.	Tsu.	Esq.
		Yuk.	Yuk.	Yuk.	Yuk.	Yuk.	Yuk.	Yuk.	Yuk.	Cal.
		Cal.			Cal.	Cal.	Cal.	Cal.	Cal.	Yuk.

* Numbers refer to Catalogues of the Smithsonian Institution. Weight in grams; capacity in cubic centimetres, other measurements in millimetres.

tution. Besides the measurements of the above, I have added those of an Esquimau skull from Labrador, belonging to Dr. Luther Parks, of casts of the crania, one each, of an Esquimau and Tunguse in the Museum of Comparative Zoölogy in Cambridge, and of twenty crania of Esquimaux from the eastern and western shores of Arctic America and from Greenland. These last are the average of measurements extracted from the Thesaurus Craniorum of Dr. Davis.

The crania of Tsuktshi are so rare, that notwithstanding the small number, I have ventured to make comparison between these and crania from the arctic shores, and northwest portions of America. The crania from the Yukon River have an especial interest, since they come from a region so nearly adjoining that occupied by the Esquimaux, which last, of all the American races, most nearly resemble Mongolians.

Arranging the crania in three groups, viz.: the Tunguse and the Tsuktshi, the Esquimaux, and the North American Indians, it will be seen by an inspection of the table that the Tunguse, Tsuktshi and Esquimaux more nearly resemble each other, than either of these do the North American Indians. The largest number of maxima are found in the first and second groups, and of minima in the third. In the lower part of the table, under each of the different heads, the races are arranged in the order of the numerical superiority of their respective measurements. In the case of casts, several measurements were necessarily omitted.

The Californians are the most brachycephalic, and the Esquimaux the most dolichocephalic. The Esquimaux exceed all others in height, and all except the Tunguse in circumference. The Tsuktshi crania are the most capacious.

The position of the foramen magnum in the Tsuktshi, as will be seen by the table, p. 446, is very nearly the same as in the white races, the index being 45.3; in the single Esquimau in which it was determined it is 43.7, in the Californians it is 42.2, and in the Yukon River Indians only 40.2.

Excepting the crania cited from the Thesaurus Craniorum of Dr. Davis, where the peculiarity is not considered, all the others but four are deficient in the sharp ridge of bone which is so distinct in Europeans, and forms the boundary between the floor of the cavity of the nostrils, and the outer surface of the upper jaw.

The crania of the Flatheads exceed in capacity those from the Yukon River and California, showing that the artificial distortion does not necessarily diminish their size. The other measurements of this group serve to show the effects of compression, but are not suited for close comparisons with the other races.

Among the crania from California are two taken from a cave, incrusted both on the outer and inner surface with stalagmite. Attention to the locality was directed by Mr. George Gibbs of Washington, and the crania were obtained by Prof. J. D. Whitney, State Geologist. They show no peculiarities in which they are distinguished from other crania from California. A complete series of measurements could not be given without removing the stalagmite, which incrusted nearly the whole surface of each.

5. SYNOSTOTIC CRANIA.

Deformities of the head accompanying a premature closing of the sutures, were first treated of at length by Virchow, Lucae and Welcker in Germany, and subsequently by Drs. Minchin, Turner, Bhurnham, J. Barnard Davis and Prof. Huxley in England.* The three chief kinds recognized are, 1st, the long head, accompanying the closure of the sagittal suture; 2d, the short and high head, associated with the closure of the coronal and lambdoidal sutures; and, 3d, the curved head, in which these last sutures are closed only on one side. The crania here described belong to the first group, and are all long.

I. This cranium belonged to the collection of Dr. Gaspard Spurzheim, and is deposited in the Anatomical Museum of Harvard College at Cambridge. Nothing is known of its history. It came from a subject somewhat advanced in life; the bones have a dense texture, the coronal suture is partially, and the sagittal and lambdoidal sutures are wholly closed. The lengthening of the head has taken place mostly forwards, as appears from the fact that the forehead is very protuberant, and the index of the foramen magnum is only 40.3; Viewed from above, the cranium is somewhat contracted behind the coronal suture, and the whole is slightly curved with a concavity to the left side. The occipital condyles are anomalous, that on the right being almost flat, except at the outer edge, where it is vertical, and the left being divided into two distinct facets, also flat, which are on different planes, the ordinary movements of the head on these surfaces must have been almost null.

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* For a full discussion of the subject by English authorities see the following articles:—

On Cranial Deformities, and more especially on the Scaphocephalic Skull. By William Turner, M. B. Nat. Hist. Review, Vol. IV., 1864, p. 88.

On Synostosis of the Cranial Bones Regarded as a Race-Character in one Class of Ancient British and in African Skulls. By John Thurnham, M. D. Nat. Hist. Review, Vol. V., 1865, p. 242.

On Synostotic Crania Among Aboriginal Races of Men. By J. Barnard Davis, M. D. With eleven plates. London, Williams and Norgate.

Thesaurus Craniorum. By Joseph Barnard Davis, M. D. London, 1867.

Prof. Thomas H. Huxley in Laing & Huxley's Prehistoric Remains of Caithness. London, 1866.

II. From the Warren Museum in the Harvard Medical College, is also from a somewhat aged subject. The sagittal suture is wholly, and the coronal, lambdoidal and squamous sutures are partially closed. The index of the foramen magnum is 43.9, showing that the head has been lengthened forwards more than backwards. A third articular surface exists on the middle of the fore-edge of the foramen magnum, and corresponds with the apex of the odontoid process of the axis. It is a smooth, oval depression, with slightly raised borders, and has the appearance of having been covered with an articular cartilage; it is supported by a very slight elevation of bone, as in the cases of *condylus tertius* described by Dr. Halbertsma. When viewed from behind, as in Fig. 2, this cranium is remarkable for the manner in which the lateral walls slope towards the vertex.

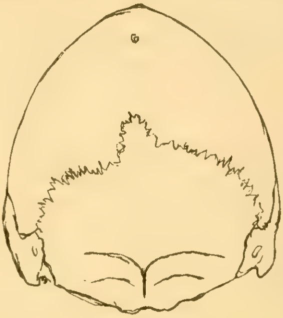

Fig. 2.

III. From the Anatomical Museum at Cambridge. This cranium belonged to a dissecting room subject, is that of an adult, is of a rough texture, but its deformity is not strongly marked. The sagittal suture is wholly closed, as is also the left squamosal, and, in addition, the spheno-parietal, the spheno-frontal, the left spheno-squamosal, and the lower ends of the coronal. The others are open, though showing a tendency to close. When viewed from the base, the cranium is slightly curved, having a concavity on the left side, that is, to the side where the sutures are most extensively closed.

IV. Cranium of a child from the Spurzheim collection. The age is presumed to be somewhat under seven years, but the process of dentition has gone on somewhat irregularly, and leaves the precise age doubtful. The sagittal suture is closed, except for about three-fourths of an inch at the fore part; the frontal suture is open at its hinder part to about the same extent. In the line of the union of the parietal bones is a slight ridge, and on each side of this a series of vascular openings and channels, which have a radiated arrangement, and which give an appearance as if the two parietals had been ossified from a single centre. All of the other sutures were open. The index of the foramen magnum is 51.8, which shows that the head has been lengthened backwards more than forwards. The side walls of this skull slope towards the vertex, but to a less degree than in the preceding specimen.

V. From the Warren Museum, and supposed to be from a subject about three years old, and is represented in Figs. 3 and 4. The milk teeth are fully developed, but the crowns of the permanent incisors are deeply buried in their alveoli. The sagittal suture is wholly obliterated; the median ridge and the vascular openings, with the peculiar radiated appearance described in the preceding specimen, as also the appearance of a median centre of ossification, exist here in a marked degree. This cranium is remarkable for its great length, the index of breadth being only 62.6. The foramen magnum is central, the increase in length having taken place equally forwards and backwards. This also appears from the equal protuberance of both forehead and occiput. The occipital region presents outwardly, as it were, a cast of the cerebellum, two bulgings corresponding with the lateral lobes, project downwards beyond the tips of the mastoid processes. The hinder lobes of the cerebrum can also be traced in a similar way, and form a third bulging in the outer surface of the occiput.

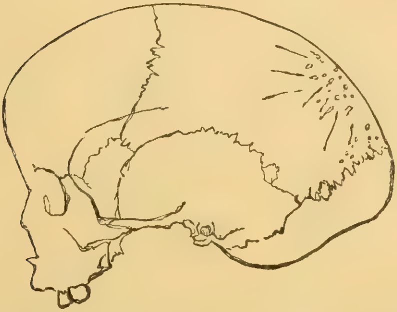

Fig. 3.

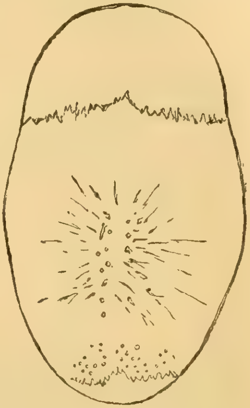

Fig. 4.

VI. Cranium of a fœtus from the Warren Museum, represented in Figs. 5 and 6, of a little less than one-half the natural size, linear measurement. In the preparation of the skull the bones were somewhat displaced in consequence of the extent to which decomposition had taken place, but are drawn as if in their natural position. Dr. J. B. S. Jackson, however, observed, when the head was still recent, that the deformity similar to that of the preceding specimens was quite marked. The measurements and proportions given below are, we believe, approximately exact. The lengthening of the head is almost wholly forwards, the index of the foramen magnum being only 32.2. The anterior fontanelle is largely open, and is prolonged between the frontals by a space with parallel sides twenty millimetres in breadth, extending nearly to the nasals. The sagittal suture is completely obliterated in the middle portion for the space of nearly an inch, Fig. 6; for the rest of its extent it is open, the two parietals approaching each other quite closely; in the fore-part the edges are smooth and straight, and in the hinder somewhat serrated, but do not touch. The frontals are very protuberant, and on the inside of each, corresponding very nearly with the frontal eminences, are two marked depressions, causing the bone to appear diaphanous in some parts, but, in others, extending quite through; each of these is surrounded by a ridge of dense bone quite unusual in a fœtal cranium. These deformities may be compared to the digital impressions of the adult crania.

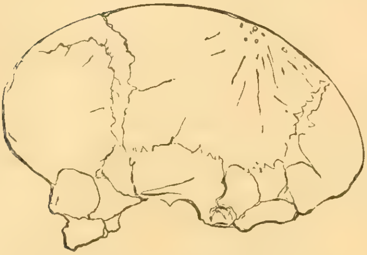

Fig. 5.

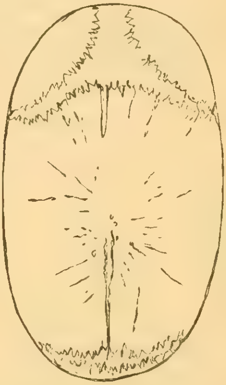

Fig. 6.

VII. To the above instances may be added the following interesting case communicated to me by Dr. W. G. Wheeler of Chelsea, Mass. A. B. was born with the fontanelles closed; when nine months old she had severe convulsions, after which her health remained feeble. When three years old the convulsions returned, with symptoms of effusion; these were at length followed by gradual recovery; she is now (1867)

TABLE OF MEASUREMENTS OF SYNOSTOTIC CRANIA.

	Capacity.	Length.	Breadth.	Height.	Index of Breadth.	Index of Height.	Index of Foramen Magnum.	Frontal Arch.	Parietal Arch.	Occipital Arch.	Circumference.	Longitudinal Arch.	Length of Frontal.	Length of Parietal.	Length of Occipital.	
I.	1440	202	135	120	675	600	413	304	290	273	548	404	145	140	116	Adult.
II.	1520	203	134	122	664	615	435	305	290	280	546	400	125	146	131	"
III.	1500	196	137	120	699	612	485	304	302	271	540	384	132	140	111	"
Average.	1486	200.3	135.3	120.6	679	609	444.3	304.3	294	274.6	544.6	396	134	142	119.3	
IV.	1405	189	126	126	666	666	518	280	293	254	504	392	125	146	120	Child.
V.	1010	186	116	114	626	616	473	265	265	231	482	372	120	140	112	"
Average.	1207.5	187.5	121	120	646	641	545.5	272.5	279	242.5	493	382	122.5	143	116	

Capacity in cubic centimeters; other measurements in millimeters.

seven years old, healthy, mind clear and memory good. The chief measurements of the head are as follows:—

Length	187	millimetres.
Breadth	133	"
Circumference	308	"
Parietal arch, "over top of head from ear to ear"	270	"
Index of breadth	71	

The deformity, it will be seen, is not great, but the photograph of the patient which Dr. Wheeler sent with the notes of the case, shows the elongated form characteristic of synostotic skulls.

From a comparison of the above cases, it will be seen that the crania from the fœtal period, childhood, the adult and advanced periods of life, present a similar deformity, viz.: lengthening of the head attended with the closure of certain sutures. The closure of the sagittal suture is, however, the only constant condition. The theory of the deformity we are describing is as follows: increase in the length of the head, during growth, depends chiefly upon the deposit of new bone on the edges of the bones in the direction of the sagittal suture; if this be prematurely closed, increase of breadth being limited, the brain, as it continues to grow in order to be accommodated, compels an increase of the bones in other directions, especially in length; consequently there results a protuberant forehead and occiput, one or both.

If this theory be correct, then it seems clear that the closure of the sagittal suture in the above crania must have taken place at very different ages, otherwise their breadths would have been more uniform. In fact, the breadths of the first three differ but little from the normal quantity, measuring 135 instead of 142 m. m., while their length is obviously increased, this being 200 instead of 180 m. m.

It appears that the lengthening of the head depends chiefly upon the abnormal growth of the parietal bones, the others remaining scarcely altered, as will be seen by the following average measurements, in which eleven normal adult crania are compared with the three adult synostotic crania described above.

	Frontal.	*Parietal.*	*Occipital.*
Normal	125 m. m.	124 m. m.	117 m. m.
Synostotic	129.2 "	148 "	119 "

The anomaly, therefore, seems to pertain chiefly to the parietal region of the skull. Is it connected with an anomalous condition of the corresponding portion of the brain?

The peculiar appearance noticed in crania IV and V, consisting of radiating canals and foramina, would seem to give support to the statement of Von Baer, that in synostotic crania, the two parietals had but one centre of ossification. The fact that in IV the sagittal suture remains partially open at either end, and that in VI the parietals are united for so short a distance, seems to render it quite certain that they were originally separate.

The *height* of the crania is much below the average, being only 120.6 m. m., while according to Dr. Davis, the average height of one hundred and twenty-eight normal crania, consisting of those of English, Netherlanders, Chinese, Negroes, etc., was 142.6 m. m. This fact brings to notice a point which is worthy of careful attention. According to theory, the height of the head depends upon the growth of bone in the lateral sutures, viz.: the spheno-frontal, spheno-parietal and the squamosal. It appears that synostotic crania, attended with lengthening, are characterized by insufficient height. Nevertheless the obliteration of the sutures just mentioned is not constant; they are freely open in IV, V and VI, in which the longitudinal deformity is very strongly marked. Why is the compensatory growth only in longitudinal direction, when, as it would seem, the conditions favoring it upwards exist as well. Even in the fœtus, VI, the sagittal suture is only partially closed, while all the others are normally open, and yet the lengthening has become extreme. Is it certain that the closing of the suture precedes the deformity, and is therefore the cause of it?

The average capacity of the adult synostotic crania, 1486 c. c., is somewhat below the normal average (1524 c. c.), according to Morton's tables, but only 3 c. c. less than that of thirty-nine English crania (1489 c. c.), according to Davis. The average of eight Scaphocephalic crania in Dr. Thurnham's table is 1532 c. c., or 8 c. c. above the normal capacity, according to Morton. There is, on the whole, no marked deviation from the normal quantity.

6. NEANDERTHAL SKULL.

In connection with synostotic crania we will offer a single remark with regard to this much discussed cranium. Among the different views brought forward to account for its peculiar shape, is that of synostosis, which has been urged by Dr. Davis, and denied by Prof. Huxley. There is one fact which we have not seen noticed in the discussion of the question at issue, though it has doubtless been observed, and in which the Neanderthal differs from common synostotic skulls. From what has been stated on p. 460, it appears that in all of the latter, there described, the increased length of the head is chiefly due to the extension of the parietal bones from before backwards, the frontal and occipital being but slightly augmented. In the

Neanderthal skull, the length of the parietals is only 115 m. m., 9 m. m. *below* the average, while in the synostotic crania it is 148 m. m., or 24 m. m. *above* the average. How far this has any real bearing on the nature of the deformity of the Neanderthal cranium will depend upon the extent to which, when large collections are examined, the extension of the parietals and consequent lengthening of the sagittal suture is found to be a constant attendant on synostosis. As far as our own observations go they are constant; and consequently the fact that in the disputed skull, the parietals are shorter than the average, is opposed to the theory of synostosis.

Dr. C. T. Jackson called the attention of the Society to some of the modern methods for the preservation and coloration of wood.

The first experiments recorded are those of Champy, who stuffed wood with tallow at 200° centigrade, the heat driving out the moisture and air, while on lowering the temperature the atmospheric pressure drove the solution into the cells of the wood. Champy's process certainly did protect ship timber from the penetration of water to a great extent, and by induration of the albuminous matters in the wood, it was rendered less liable to decay; but it was found impossible to penetrate the whole thickness of hard wood timber with the solution.

Kyan preserved wood from decay by impregnating it with a solution of one one-hundreth part of bi-chloride of mercury. This prevented decay by poisoning the wood so that insects and parasitic vegetation would not destroy it, and the bi-chloride formed a well known combination with the albumen, and so conserved it.

Mohl removed the air from the cells of wood by steaming it, and then drove in the vapor of creosote, which has the property of preserving albuminous or nitrogenous substances, and of preventing insect depredations. This process is very similar to one recently patented in this country by a Mr. Robbins, and which is now in operation under the directions of the American Wood Preserving Company. Of this process I shall speak presently.

Boucherie employed the natural powers of absorption in living trees freshly cut down; a bag of impermeable stuff, india rubber cloth, or prepared leather, is firmly bound around the end of the cut-off stump end of the tree, and the preservative liquid supplied to this by a barrel placed a little above it, having a tube communicating with the bag. The liquid rapidly follows the sap of the tree, so that it is soon found in the branches and leaves. Dye stuffs, with their proper mordants are also introduced in the same way, and richly colored woods are produced. Even bleaching salts have thus been introduced into trees with acids to disengage the chlorine, and wood, white as ivory, has been made for ornamental use.

Perrin improved these processes and also was enabled to effect a more thorough impregnation of wood by making a vacuum at one end of the logs while the atmospheric pressure drove the dye stuffs into the wood. He was the first who introduced mordants to aid the action of the dyes. He colored wood with solutions of the different madder colors and fixed them with alum. He used logwood, Brazil wood, indigo, nitrate and acetate of copper and verdigris, giving a great variety of tints to the same wood. Pyrolignite of iron, or iron liquor of the calico printer, proved to be one of the most effective dyes and preservatives.

Some of the agents used in the preservation of wood act as follows:—tannin acts on the albuminous matters in the same way as on animal tissues; tar and creosote dissolved in pyroligneous acid are eminently antiseptic; oils, fats and resins keep out humidity; sea salt and chloride of calcium give flexibility to wood and prevent some chemical changes; sulphate of copper acts very much like the bi-chloride of mercury used by Kyan; pyrolignite of iron (Boucherie's process) both colors and conserves, the iron taking the tannin and producing a violet blueish tint, while the creosote in the acid is antiseptic; chloride of zinc (Burnet's proces) acts like the bi-chloride of mercury and is cheaper; acetate of lead tends to preserve the albumen; rosin dissolved in hot oil is principally used to keep out water; a hot mixture of wax and tallow is sometimes used; the wood absorbs from 15 to 60 per cent. of its weight and is much improved in imperviousness to water, but wax is too costly; marine glue or shellac and india rubber dissolved in coal tar are good, so far as they can be made to penetrate, and effectually prevent the wood from cracking.

I have found that the most effective and perfect stuffing of wood can be effected by immersing it in very hot paraffine, and withdrawing the air from the wood cells by the air pump and then letting on the atmospheric pressure. By means of paraffine we may preserve any kind of wood perfectly, and prevent its swelling or shrinking from moisture or dryness. The wood may be sand-papered, or pumiced and polished very highly.

Paraffine in vapor cannot be used, since the heat required to vaporize it is too great for wood to bear without becoming brown.

I have advised the manufacture of refrigerators with white wood boards stuffed with paraffine, since paraffine will not absorb or give out odors, nor will it admit moisture. Indeed, it is as its name signifies, almost without affinities.

The American patented process of Robbins is one of the most practicable methods for the preparation of heavy pieces of timber and for out-of-door work. It is especially adapted for the preparation of railway sleepers and ties, and for the preparation of wheel hubs, spokes and felloes. It is not so well adapted for furniture, since the wood smells strongly of carbolic acid or creosote. Green wood, as well as dry, is prepared by the wood preserving company. Sails, ropes, and rigging for ships is also prepared by the same process, so that they will not mildew or rot; but I have not yet seen samples of the sails and ropes thus prepared. The process is extremely simple. It is nothing more than exposing the wood in a steam box into which coal tar vapor is driven at a temperature of about 300° or 350°F. All the moisture and air are expelled from the wood-cells and coal tar products take their place. The charge of wood placed on an iron chariot may be run into the box, and in half an hour it may be withdrawn fully impregnated. It is proposed to place one of these machines on trucks to prepare the ties and sleepers on the railroads as the work progresses. There are two companies engaged in this work, one in New York and one in Boston.

Messrs. N. L. Hooper, R. C. Greenleaf and C. J. Sprague were chosen a committee to nominate officers for the ensuing year.

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ERRATA AND AUTHORS' ADDITIONS.

Page 40, line 12. Anarta nigrolunata Pack.=A. melanopa (Thunb.).

Page 52. *Dele* Cidaria destinata and the references, and add to the list Cidaria abrasaria H.-S. Found at Caribou Island, Straits of Belle Isle.

Page 53, line 23. Eudorea? frigidella=Pempilia fusca (Haworth). This is not a Pempilia.

Page 57, foot note. *For* Penthina glaciana *read* Tortrix gelidana.

Page 74, line 28. *For* Mycroscopy *read* Microscopy.

Page 81, line 1. *For* Actinopticus *read* Actinoptychus.

Page 82, second plate of wood cuts, lower right hand figure. *For* Navicula prætexa var. *read* Navicula prætexta (typical form).

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